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CONTENTS

2001

5201 TORRES, G.; LACY, C. H. S.; GUILBAULT, P. R.; DIETHELM, R.; BALDWIN, M. E.; LUBCKE, G. C.:
The Period of LV Herculis Revisited . . . . 1 – 3
5202 LLOYD, C.; WEST, K.:
Photoelectric Observations of the Complex Low-amplitude Red Variable, UX Dra . . . . 1 – 4
5203 BERNHARD, K.; MOSCHNER, W.:
On the Variability of V1538 Aql (Brh V17) and GSC 1123.1704 (Brh V28) 1 – 3
5204 MOSCHNER, W.; FRANK, P.; AGERER, F.:
New Elements for the Eclipsing Binary V1036 Cyg . . . . 1 – 3
5205 VAN CAUTEREN, P.; WILS, P.:
GSC 2118-00297: a New Double-Mode δ Scuti Variable . . . . 1 – 3
5206 BORKOVITS, TAMÁS; BÍRÓ, IMRE BARNA; KOVÁCS, TAMÁS:
New CCD Times of Minima of Eclipsing Binary Systems . . . . 1 – 2
5207 VANDENBROERE, J.; PIGULSKI, A.; VAN CAUTEREN, P.:
NSV 12223: a New W UMa Eclipsing Binary . . . . 1 – 4
5208 WATANABE, T.:
Period Change of ES Del . . . . 1 – 3
5209 PERCY, JOHN R.; NYSSA, ZOË; HENRY, GREGORY W.:
Periods of Eleven K5-M0 Pulsating Red Giants . . . . 1 – 4
5210 ACHTERBERG, H.; HUSAR, D.:
The RRab Star UX Tri: Discovery of a Blazhko Effect with Changing Period . . . . 1 – 4
5211 ROBB, R. M.; LINDNER, J. V.; STERN, L. A.; LINDNER, T. H.; BALAM,D. D.; CLEM, J. L.:
Photometric Variability of the Stars USNO 0900-17903132, HD 191674 and HD 191616 . . . . 1 – 4
5212 AGERER, F.:
New Type and Elements for the Eclipsing Binary OT Cep . . . . 1 – 2
5213 YUSHCHENKO, A. V.; GOPKA, V. F.; KHOKHLOVA, V. L.; TOMKIN, J.:
Orbital Elements of SB2 System 66 Eri . . . . 1 – 3

2002

5214 SEMKOV, E.H.:
UBVRI Observations of V350 Cep in the Period 1998-2001 . . . . 1 – 4
5215 PIKHUN, A.I.; YUSHCHENKO, A.V.:
Machine Readable Catalog of Odessa Patrol Plates . . . . 1 – 2
5216 PASTUKHOVA, E. N.:
A New Eclipsing Binary in Sagitta . . . . 1 – 2
5217 LLOYD, C.; PICKARD, R. D.; CHAMBERS, R. H.:
The Periods of the Semiregular Variable V370 And . . . . 1 – 4

5218 PIGULSKI, A.; MICHALSKA, G.:
NN Ser and V664 Cas: Two Pre-cataclysmic Binaries with Large Reflection Effect .... 1 – 4
5219 BEHREND, R.; BUIL, CH.; ANTONINI, P.; DEMEAUTIS, CH.:
GSC 628_290: a New EW/KW Variable .... 1 – 2
5220 BALDINELLI, LUIGI; MAITAN, ALESSANDRO:
CCD Minima of Selected Binary Stars in 2001 .... 1 – 2
5221 RICHMOND, M. W.:
GSC 01621-02192: A New W UMa Eclipsing Binary .... 1 – 3
5222 ARÉVALO, M. J.; LÁZARO, C.; BARRERA, E.; DOMINGUEZ, R. M.:
J and K Infrared Light Curves of the Active Binary BH Vir .... 1 – 4
5223 JASSUR, D. M. Z.; ZAREI, A.; KERMANI, M. H.:
UBV Light Curves of AK Her .... 1 – 2
5224 NELSON, ROBERT H.:
Minima of Binary Stars .... 1 – 4
5225 KAZAROVETS, E. V.; PASTUKHOVA, E. N.:
HadV67 = V648 Oph, a Remarkably Regular Mira .... 1 – 3
5226 SMITH, D. A.; AKERLOF, C.; ASHLEY, M. C. B.; CASPERSON, D.; GISLER, G.; HENDEN, A.; MARSHALL, S.; MCGOWAN, K.; MCKAY, T.; PHILLIPS, M. A.; RYKOFF, E.; SHECTMAN, S.; VESTRAND, W. T.; WOZNIAK, P.:
Discovery of the CV ROTSE3 J015118.59–022300.1 .... 1 – 4
5227 MARINO, G.; CATALANO, S.; FRASCA, A.; MARILLI, E.; TERIACA, L.:
Radial Velocities and Orbital Solution of the Active Binary Star FG Ursae Majoris .... 1 – 4
5228 NELSON, R. H.; LUBCKE, G. C.; HENDEN, A. A.; GUILBAULT, P. R.:
Eclipsing Variable GSC 2084.0777 = ROTSE1 J174103.55+273429.1 .... 1 – 4
5229 HOWELL, J. A.; HENDEN, A. A.; BALDWIN, M. E.; GUILBAULT, P. R.; HAGER, T.; WEST, D.; KUEBLER, P.; TERRELL, D.:
Light Elements and Light Curve of the Eclipsing Binary GSC 2605.0545 .... 1 – 4
5230 CSIZMADIA, SZ.; ZHOU, A. Y.; KÖNYVES, V.; VARGA, Z.; SÁNDOR, ZS.:
Times of Minima of Eclipsing Binaries .... 1 – 2
5231 KAISER, D. H.; PULLEN, A. C.; HENDEN, A. A.; BALDWIN, M. E.; GUILBAULT, P. R.; HAGER, T.; TERRELL, D.:
GSC 0983.1044: A Short-period RS CVn Binary .... 1 – 4
5232 BLÄTTLER, E.; DIETHELM, R.:
CCD Light Curves of ROTSE1 Variables, XIII: GSC 3104:1384 Lyr, ROTSE1 GSC 2632:319 Lyr, GSC 3540:85 Lyr AND GSC 3549:929 Dra .... 1 – 4
5233 KIMESWENGER, S.; SCHMEJA, S.; KITZBICHLER, M. G.; LECHNER, M. F. M.; MÜHLBACHER, M. S.; MÜHLBAUER, A. D.:
Period and Proper Motion of 1RXS J232953.9+062814 .... 1 – 3
5234 BERNASCONI, L.; BEHREND, R.:
GSC 650_475 and GSC 650_769: Two New Variable Stars .... 1 – 3
5235 ROVITHIS-LIVANIOU, H.; ROVITHIS, P.; DJURAŠEVIĆ, G.:
The Variability of the Orbital Period of RZ Comae Berenices .... 1 – 4
5236 PAZHOUHESH, R.; EDALATI, M. T.:
New Elements of the Contact Binary V839 Ophiuchi .... 1 – 3

5237 BOECHE, C.; MUNARI, U.; TOMASELLA, L.; BARBON, R.:
Spectroscopic Orbit of the Eclipsing Binary V2031 Cyg in the Field of the Open Cluster NGC 6913≡M 29 . . . 1 – 4
5238 RODRÍGUEZ, E.; GARCÍA, J. M.; MKRTICHIAN, D. E.:
HD 12582: A New δ Sct Variable . . . 1 – 2
5239 DEREKAS, A.; KISS, L. L.; SZABÓ, GY. M.; FŰRÉSZ, G.; SÁRNECZKY, K.; HEINER, ZS.:
The Primary Minimum of OW Geminorum in 2002 . . . 1 – 4
5240 SPOGLI, C.; FIORUCCI, M.; TOSTI, G.; NUCCIARELLI, G.; GIRETTI, A. M.; MONACELLI, G.; MACCHIA, E.:
$BV(RI)_C$ Observations of Some Dwarf Novae . . . 1 – 4
5241 ARÉVALO, M. J.; LÁZARO, C.; BARRERA, E.:
Infrared Light Curves of the Binary System HY Vir . . . 1 – 4
5242 HÁJEK, P.; KOSS, K.; KUDRNÁČOVÁ, J.; MOTL, D.:
Variability of GSC 3151.0633 . . . 1 – 3
5243 KATO, TAICHI:
Unusual Outbursting State of a Z Cam-Type Star HL CMa . . . 1 – 3
5244 KIM, S.-L.; KWON, S.-G.; YOUN, J.-H.; KYEONG, J.-M.; LEE, J. W.:
HD 275525, GSC 02866-01866 and GSC 03429-01645: Three New Delta Scuti Type Variables . . . 1 – 4
5245 ZBORIL, M.:
Minima of SV Cam from January 2001 - February 2002 . . . 1 – 2
5246 ANTIPIN, S. V.; SHUGAROV, S. YU.; KROLL, P.:
Missed Nova Aquilae 1985 on Moscow and Sonneberg Plates . . . 1 – 4
5247 STARK, M. A.; TAYLOR, J. M.:
A New Short Period Variable Star in Cygnus . . . 1 – 2
5248 VAN CAUTEREN, P.; WILS, P.; LAMPENS, P.; STRIGACHEV, A.:
On the Period of the High Amplitude δ Scuti Variable DW Psc . . . 1 – 4
5249 STANISHEV, V.:
NSV 786 is Not a Cataclysmic Variable . . . 1
5250 PANOV, KIRIL P.; DIMITROV, DINKO P.:
The Flare Activity of UV Ceti 1982−1984 . . . 1 – 3
5251 LACY, C. H. S.; STRAUGHN, A.; DENGER, F.:
Times of Minima of Eclipsing Binaries . . . 1 – 3
5252 KOZHEVNIKOV, V. P.; KOZHEVNIKOVA, A. V.:
Observations of Outside-eclipse Brightness Variations of CM Dra . . . 1 – 4
5253 SPOGLI, CORRADO; FIORUCCI, MASSIMO; NUCCIARELLI, GIULIANO; TOSTI, GINO; RAIMONDO, GABRIELLA; MACCHIA, ENRICO; MONACELLI, GIUSEPPE:
$BV(RI)_C$ Observations of FY Vul . . . 1 – 3
5254 ANTONELLO, E.; FUGAZZA, D.; MANTEGAZZA, L.; STEFANON M.:
Variable Stars in Field A of NGC 6822 . . . 1 – 4
5255 DEREKAS, A.; KISS, L. L.; BEBESI, ZS.:
New $V(RI)_C$ Photometry of SW Lacertae and AB Andromedae . . . 1 – 4
5256 ZALINIAN, V. P.; TOVMASSIAN, H. M.; CARDONA, O.:
Observations of the Flare Star EV Lac in 2000-2001 . . . 1 – 4
5257 KOFF, R. A.; HENDEN, A. A.; KAISER, D. H.; LUBCKE, G. C.; TERRELL, D.:
GSC 4686 2315: A Short-period Algol . . . 1 – 3

5258 PRIBULLA, T.; CHOCHOL, D.; VAŇKO, M.; PARIMUCHA, Š.:
The First Ground-based Photometry of Contact Binaries FN Cam and EX Leo .... 1 – 4
5259 Errata for Issues 4997 and 5145 1
5260 LLOYD, C.; FRANK, P.; BERNHARD, K.; MOSCHNER, W.:
GSC 1377-0969 (Brh V65), GSC 0477-0889 (Brh V100) and GSC 0669-0674 (Brh V102) are New W UMa Variables .... 1 – 4
5261 SIL'CHENKO, O. K.; MOISEEV, A. V.:
Emission-line Flare of ES 560B .... 1 – 3
5262 KATO, TAICHI; MATSUMOTO, KATSURA; UEMURA, MAKOTO:
V893 Sco Is Not an ER UMa-Type Star .... 1 – 4
5263 ŠAFÁŘ, JAN; ZEJDA, MILOSLAV:
CCD Times of Minima of Faint Eclipsing Binaries III .... 1 – 9
5264 BORISOV, G.; DIMITROV, D.; SEMKOV, E.; APOSTOLOVSKA, G.; BONEV, T.; IVANOVA, A.; BILKINA, B.; IVANOVA, V.; PANOV, K.:
UBVRI Photometry of SN 2002ap in M74 .... 1 – 3
5265 ANTIPIN, S.V.:
A New 7-day Classical Cepheid in Cassiopeia .... 1 – 2
5266 THORSTENSEN, J. R.:
Recovery of AS Psc at Minimum Light .... 1 – 3
5267 WILS, P.; VAN CAUTEREN, P.; LAMPENS, P.:
Multiperiodicity in the δ Scuti Variable GSC 2899-00521 .... 1 – 4
5268 KATO, TAICHI; UEMURA, MAKOTO; ISHIOKA, RYOKO:
Outburst Photometry of EY Cyg .... 1 – 4
5269 BLÄTTLER, E.; DIETHELM, R.:
CCD Light Curves of ROTSE1 Variables, XIV: GSC 1996:437 Com, GSC 2004:784 CVn, GSC 2001:300 Boo and GSC 3026:1046 CVn .... 1 – 4
5270 SOROKIN, P.; ANTIPIN, S.; SAMUS, N.:
GSC 1609.00690, a New Classical Cepheid .... 1 – 2
5271 KOFF, R. A.; ROBB, R. M.; THANJAVUR, K.; HENDEN, A. A.; KAISER, D.H.; KUEBLER, J.P.:
The Reddened W UMa System: GSC 1851-0320 .... 1 – 4
5272 ZALINIAN, V. P.; TOVMASSIAN, H. M.; CARDONA, O.; CHAVEZ, M.:
Observations of Flare Stars V577 Mon and AD Leo .... 1 – 4
5273 DONLEY, J.; FRIED, ROBERT; JONES, CAITLYNN; WADE, RICHARD A.:
Light Maxima of the RRab Variable TU UMa in Early 2002 .... 1 – 2
5274 GIELES, M.; OROSZ, J. A.; HULLEMAN, F.; BROGT, E.; BAILYN, C. D.; GARCIA, M. R.:
Ten New Semi-regular Variables in Sagittarius .... 1 – 7
5275 HAZEN, M. L.; HOFFLEIT, D.; KAZAROVETS, E.; KROLL, P.; SAMUS, N.; WEBBINK, R. F.:
OP Aql and V926 Aql .... 1 – 3
5276 SPOGLI, CORRADO; FIORUCCI, MASSIMO; TOSTI, GINO; CIPRINI, STEFANO; NUCCIARELLI, GIULIANO; MACCHIA, ENRICO; MONACELLI, GIUSEPPE:
BVRI Observations of AH Her in the Years 2000-2001 .... 1 – 4
5277 GOMEZ-FORRELLAD, JOSEP M.; GARCIA-MELENDO, ENRIQUE:
The New Short Period EB Eclipsing Binary System GSC 01343-02414 .... 1 – 2

5278 GARCIA-MELENDO, ENRIQUE; JUAN-SAMSO, JORDI:
The New Classical Cepheid NSV 02852 . . . . . 1 – 3
5279 NARUSAWA, S.; WAKI, Y.; IOROI, M.; TAKEUTI, M.:
Short Period Variability of the Algol System AI Dra . . . . . 1 – 3
5280 BRANICKI, A.; PIGULSKI, A.:
V357 Her: Another W UMa-Type Eclipsing Binary Misclassified as HADS 1 – 4
5281 CHRISTIAN, DAMIAN J.; MATHIOUDAKIS, MIHALIS; VENNES, STEPHÁNE:
EUVE J2244−15.9: A New Spectroscopic Binary . . . . . 1 – 2
5282 ALIS, SINAN; KESKIN, M. MUSTAFA; ATAY, M. ERAY:
Erratum to IBVS No. 4855 and Times of Minima of the Eclipsing Binary V357 Pegasi . . . . . 1 – 2
5283 COOK, L. M.; KATKOVA, E. V.; SOKOLOV, N. A.; GUSEVA, I. S.:
BVRI Photometry of the Type Ic Hypernova SN 2002ap . . . . . 1 – 3
5284 KATO, TAICHI; UEMURA, MAKOTO; ISHIOKA, RYOKO; MATSUMOTO, KATSURA; TANABE, KENJI:
New SU UMa-Type Dwarf Nova DM Dra . . . . . 1 – 4
5285 NELSON, ROBERT H.; ROBB, RUSSELL M.; KAISER, DAN H.; BILLINGS, GARY B.:
The Contact Binary GSC 3551-1708: Light Curve Analysis . . . . . 1 – 4
5286 PEJCHA, O.; SOBOTKA, P.; ŠMELCER, L.; DUBOVSKÝ, P. A.; BRÁT, L.; HENDEN, A. A.:
Has AY Dra Increased Amplitude? . . . . . 1 – 4
5287 ZEJDA, MILOSLAV:
CCD Times of Minima of Faint Eclipsing Binaries in 2000 . . . . . 1 – 8
5288 BEDIENT, J. R.:
NSV 12364: A Semiregular Variable . . . . . 1 – 3
5289 GIELES, M.; OROSZ, J. A.; HULLEMAN, F.; BROGT, E.; BAILYN, C. D.; GARCIA, M. R.:
Discovery of Four Close Binary Stars in Sagittarius . . . . . 1 – 6
5290 WAHLGREN, G. M.; HUBRIG, S.; DOLK, L.:
The Double-Lined Spectroscopic Binary AV Scl . . . . . 1 – 2
5291 GIELES, M.; OROSZ, J. A.; HULLEMAN, F.; BROGT, E.; BAILYN, C. D.; GARCIA, M. R.:
Optical Monitoring of GM Sgr and Discovery of a Mira and a Short-period Pulsator . . . . . 1 – 4
5292 ZHANG, X. B.; ZHANG, R. X:
GSC 2038_1730: a New Variable Star . . . . . 1 – 2
5293 MAYER, PAVEL; WOLF, MAREK:
A Possible Periodic Term in the Period of the Eclipsing Binary V701 Sco . 1 – 3
5294 ESHANKULOVA, M.; ZAKIROV, M.:
UBVR Photometry of the Eclipsing Binary Star V443 Cygni . . . . . 1 – 4
5295 BLÄTTLER, E.; DIETHELM, R.:
CCD Light Curves of ROTSE1 Variables, XV: GSC 2040:1361 CrB, ROTSE1 GSC 2579:1125 CrB, GSC 2035:175 Ser and GSC 2580:2086 CrB 1 – 4
5296 AGERER, FRANZ; HÜBSCHER, JOACHIM:
Photoelectric Minima of Selected Eclipsing Binaries and Maxima of Pulsating Stars . . . . . 1 – 16

5297 PASTUKHOVA, E. N.; SAMUS, N. N.; HAZEN, M. L.:
The RR Lyrae Variable CH Oph and a New Mira in its Field . . . . 1 – 3
5298 WEBBINK, R. F.; HAZEN, M. L.; HOFFLEIT, D.:
Coordinates and Identifications of Harvard Variables . . . . 1 – 44
5299 KOPPELMAN, M. D.; TERRELL, D.:
GSC 00279-00321: A New W UMa Eclipsing Binary . . . . 1 – 4
5300 ALBAYRAK, B.; TANRIVERDİ, T.; AYDIN, C.:
Photoelectric Minima of Some Eclipsing Binary Stars . . . . 1 – 2

AUTHOR INDEX

Achterberg, H. 5210
Agerer, F. 5204, 5212, 5296
Akerlof, C. 5226
Albayrak, B. 5300
Alis, Sinan 5282
Antipin, S. V. 5246, 5265, 5270
Antonello, E. 5254
Antonini, P. 5219
Apostolovska, G. 5264
Arévalo, M. J. 5222, 5241
Ashley, M. C. B. 5226
Atay, M. Eray 5282
Aydin, C. 5300
Bailyn, C. D. 5274, 5289, 5291
Balam, D. D. 5211
Baldinelli, Luigi 5220
Baldwin, M. E. 5201, 5229, 5231
Barbon, R. 5237
Barrera, E. 5222, 5241
Bebesi, Zs. 5255
Bedient, J. R. 5288
Behrend, R. 5219, 5234
Bernasconi, L. 5234
Bernhard, K. 5203, 5260
Bilkina, B. 5264
Billings, Gary B. 5285
Bíró, Imre Barna 5206
Blättler, E. 5232, 5269, 5295
Boeche, C. 5237
Bonev, T. 5264
Borisov, G. 5264
Borkovits, Tamás 5206
Branicki, A. 5280
Brát, L. 5286
Brogt, E. 5274, 5289, 5291
Buil, Ch. 5219
Cardona, O. 5256, 5272
Casperson, D. 5226
Catalano, S. 5227
Chambers, R. H. 5217
Chavez, M. 5272
Chochol, D. 5258
Christian, Damian J. 5281
Ciprini, Stefano 5276
Clem, J. L. 5211
Cook, L. M. 5283
Csizmadia, Sz. 5230
Demeautis, Ch. 5219
Denger, F. 5251
Derekas, A. 5239, 5255
Diethelm, R. 5201, 5232, 5269, 5295
Dimitrov, Dinko P. 5250, 5264
Djurašević, G. 5235
Dolk, L. 5290
Dominguez, R. M. 5222
Donley, J. 5273
Dubovský, P. A. 5286
Edalati, M. T. 5236
Eshankulova, M. 5294
Fiorucci, Massimo 5240, 5253, 5276
Frank, P. 5204, 5260
Frasca, A. 5227
Fried, Robert 5273
Fugazza, D. 5254
Fűrész, G. 5239
Garcia, J. M. 5238
Garcia, M. R. 5274, 5289, 5291
Garcia-Melendo, Enrique 5277, 5278
Gieles, M. 5274, 5289, 5291
Giretti, A. M. 5240
Gisler, G. 5226
Gomez-Forrellad, Josep M. 5277
Gopka, V. F. 5213
Guilbault, P. R. 5201, 5228, 5229, 5231
Guseva, I. S. 5283
Hager, T. 5229, 5231
Hájek, P. 5242
Hazen, M. L. 5275, 5297, 5298
Heiner, Zs. 5239
Henden, A. A. 5226, 5228, 5229, 5231, 5257, 5271, 5286
Henry, Gregory W. 5209
Hoffleit, D. 5275, 5298
Howell, J. A. 5229
Hubrig, S. 5290
Hübscher, Joachim 5296
Hulleman, F. 5274, 5289, 5291
Husar, D. 5210
Ioroi, M. 5279
Ishioka, Ryoko 5268, 5284
Ivanova, A. 5264
Ivanova, V. 5264
Jassur, D. M. Z. 5223
Jones, Caitlynn 5273

Juan-Samso, Jordi 5278
Kaiser, Dan H. 5231, 5257, 5271, 5285
Katkova, E. V. 5283
Kato, Taichi 5243, 5262, 5268, 5284
Kazarovets, E. V. 5225, 5275
Kermani, M. H. 5223
Keskin, M. Mustafa 5282
Khokhlova, V. L. 5213
Kim, S.-L. 5244
Kimeswenger, S. 5233
Kiss, L. L. 5239, 5255
Kitzbichler, M. G. 5233
Koff, R. A. 5257, 5271
Könyves, V. 5230
Koppelman, M. D. 5299
Koss, K. 5242
Kovács, Tamás 5206
Kozhevnikov, V. P. 5252
Kozhevnikova, A. V. 5252
Kroll, P. 5246, 5275
Kudrnáčová, J. 5242
Kuebler, J. P. 5229, 5271
Kwon, S.-G. 5244
Kyeong, J.-M. 5244
Lacy, C. H. S. 5201, 5251
Lampens, P. 5248, 5267
Lázaro, C. 5222, 5241
Lechner, M. F. M. 5233
Lee, J. W. 5244
Lindner, J. V. 5211
Lindner, T. H. 5211
Lloyd, C. 5202, 5217, 5260
Lubcke, G. C. 5201, 5228, 5257
Macchia, Enrico 5240, 5253, 5276
Maitan, Alessandro 5220
Mantegazza, L. 5254
Marilli, E. 5227
Marino, G. 5227
Marshall, S. 5226
Mathioudakis, Mihalis 5281
Matsumoto, Katsura 5262, 5284
Mayer, Pavel 5293
Mcgowan, K. 5226
Mckay, T. 5226
Michalska, G. 5218
Mkrtichian, D. E. 5238
Moiseev, A. V. 5261
Monacelli, Giuseppe 5240, 5253, 5276
Moschner, W. 5203, 5204, 5260
Motl, D. 5242
Mühlbacher, M. S. 5233
Mühlbauer, A. D. 5233
Munari, U. 5237
Narusawa, S. 5279
Nelson, Robert H. 5224, 5228, 5285
Nucciarelli, Giuliano 5240, 5253, 5276
Nyssa, Zoë 5209
Orosz, J. A. 5274, 5289, 5291
Panov, Kiril P. 5250, 5264
Parimucha, Š. 5258
Pastukhova, E. N. 5216, 5225, 5297
Pazhouhesh, R. 5236
Pejcha, O. 5286
Percy, John R. 5209
Phillips, M. A. 5226
Pickard, R. D. 5217
Pigulski, A. 5207, 5218, 5280
Pikhun, A. I. 5215
Pribulla, T. 5258
Pullen, A. C. 5231
Raimondo, Gabriella 5253
Richmond, M. W. 5221
Robb, Russell M. 5211, 5271, 5285
Rodríguez, E. 5238
Rovithis, P. 5235
Rovithis-Livaniou, H. 5235
Rykoff, E. 5226
Šafář, Jan 5263
Samus, N. N. 5270, 5275, 5297
Sándor, Zs. 5230
Sárneczky, K. 5239
Schmeja, S. 5233
Semkov, E. H. 5214, 5264
Shectman, S. 5226
Shugarov, S. Yu. 5246
Sil'chenko, O. K. 5261
Šmelcer, L. 5286
Smith, D. A. 5226
Sobotka, P. 5286
Sokolov, N. A. 5283
Sorokin, P. 5270
Spogli, Corrado 5240, 5253, 5276
Stanishev, V. 5249
Stark, M. A. 5247
Stefanon M. 5254
Stern, L. A. 5211
Straughn, A. 5251
Strigachev, A. 5248

Szabó, Gy. M.	5239
Takeuti, M.	5279
Tanabe, Kenji	5284
Tanriverdi, T.	5300
Taylor, J. M.	5247
Teriaca, L.	5227
Terrell, D.	5229, 5231, 5257, 5299
Thanjavur, K.	5271
Thorstensen, J. R.	5266
Tomasella, L.	5237
Tomkin, J.	5213
Torres, G.	5201
Tosti, Gino	5240, 5253, 5276
Tovmassian, H. M.	5256, 5272
Uemura, Makoto	5262, 5268, 5284
Van Cauteren, P.	5205, 5207, 5248, 5267
Vandenbroere, J.	5207
Vaňko, M.	5258
Varga, Z.	5230
Vennes, Stepháne	5281
Vestrand, W. T.	5226
Wade, Richard A.	5273
Wahlgren, G. M.	5290
Waki, Y.	5279
Watanabe, T.	5208
Webbink, R. F.	5275, 5298
West, D.	5202
West, K.	5229
Wils, P.	5205, 5248, 5267
Wolf, Marek	5293
Wozniak, P.	5226
Youn, J.-H.	5244
Yushchenko, A. V.	5213, 5215
Zakirov, M.	5294
Zalinian, V. P.	5256, 5272
Zarei, A.	5223
Zboril, M.	5245
Zejda, Miloslav	5263, 5287
Zhang, R. X.	5292
Zhang, X. B.	5292
Zhou, A. Y.	5230

INDEX OF VARIABLES

Star	IBVS No.
RT And	5206
TT And	5287
UU And	5263
AB And	5255
AD And	5220
DX And	5268
FL And	5287
KN And	5287
LM And	5263
V370 And	5217
UU Aqr	5263
DD Aqr	5220
EX Aqr	5287
FF Aqr	5218
GK Aqr	5263
R Aql	5208
OO Aql	5206
OP Aql	5275
V416 Aql	5263
V616 Aql	5287
V631 Aql	5263
V770 Aql	5263, 5287
V784 Aql	5263, 5287
V873 Aql	5263
V879 Aql	5280
V919 Aql	5263
V926 Aql	5275
V1075 Aql	5287
V1299 Aql	5287
V1343 Aql	5246
V1355 Aql	5263
V1538 Aql	5203
Nova Aql	5246
EQ Aur	5263
FW Aur	5263
HU Aur	5263
IM Aur	5206, 5230
MO Aur	5287
QT Aur	5263
V364 Aur	5263
V379 Aur	5263
TU Boo	5263
TY Boo	5263, 5287
AC Boo	5263, 5287
AR Boo	5263, 5287
CK Boo	5287
SV Cam	5245
XZ Cam	5263
AQ Cam	5263
FN Cam	5258
RY Cnc	5263
SW Cnc	5287
TY Cnc	5263
WX Cnc	5287
WY Cnc	5300
AE Cnc	5263
AH Cnc	5230
EH Cnc	5263
ES Cnc	5230
EV Cnc	5230
RS CVn	5222, 5231
RV CVn	5287
UW CVn	5280
YZ CVn	5263
BO CVn	5300
HL CMa	5243
TU CMi	5287
AG CMi	5287
AO CMi	5263
TV Cas	5230
AL Cas	5263, 5287
KT Cas	5263
MM Cas	5263, 5287
MR Cas	5263
MS Cas	5263
MT Cas	5287
PV Cas	5206
V345 Cas	5263
V360 Cas	5287
V361 Cas	5287
V364 Cas	5263
V664 Cas	5218
V702 Cas	5287

Star	IBVS No.
V851 Cas	5263
TV Cep	5287
VW Cep	5206
IM Cep	5263, 5287
LP Cep	5287
OT Cep	5212
V350 Cep	5214
V358 Cep	5263
UV Cet	5250
RZ Com	5235
CC Com	5263
CN Com	5287
DD Com	5263, 5287
DG Com	5263
EQ Com	5263, 5287
TW CrB	5220
W Crv	5287
TW Crv	5218
WZ Cyg	5220
AE Cyg	5220
CG Cyg	5220, 5300
DK Cyg	5220
DL Cyg	5206
EY Cyg	5268
GM Cyg	5263
KV Cyg	5263
PW Cyg	5263
QS Cyg	5263, 5287
QT Cyg	5287
QU Cyg	5263, 5287
QX Cyg	5263, 5287
V387 Cyg	5220
V443 Cyg	5294
V454 Cyg	5263, 5287
V456 Cyg	5220
V484 Cyg	5263
V502 Cyg	5263
V503 Cyg	5253
V505 Cyg	5287
V516 Cyg	5253
V526 Cyg	5287
V681 Cyg	5263
V693 Cyg	5263
V699 Cyg	5242
V704 Cyg	5263, 5287
V706 Cyg	5263, 5287
V711 Cyg	5263, 5287
V787 Cyg	5287
V824 Cyg	5287
V842 Cyg	5263
V865 Cyg	5263
V880 Cyg	5263, 5287
V906 Cyg	5263, 5287
V907 Cyg	5263, 5287
V931 Cyg	5263, 5287
V947 Cyg	5287
V961 Cyg	5263
V963 Cyg	5263
V970 Cyg	5263
V1004 Cyg	5263
V1010 Cyg	5263
V1019 Cyg	5287
V1036 Cyg	5204
V1047 Cyg	5263
V1048 Cyg	5263
V1057 Cyg	5214
V1130 Cyg	5263
V1321 Cyg	5263
V1414 Cyg	5263, 5287
V1515 Cyg	5214
V1580 Cyg	5263, 5287
V1787 Cyg	5263, 5287
V1823 Cyg	5259
V1908 Cyg	5263
V2031 Cyg	5237
V2239 Cyg	5263
V2240 Cyg	5263, 5287
BI Del	5263
BO Del	5263
ES Del	5208
FH Del	5287
W Dra	5208
Z Dra	5263
RZ Dra	5287
TW Dra	5263, 5287
UX Dra	5202
XY Dra	5263
AI Dra	5279
AK Dra	5287

Star	IBVS No.
AR Dra	5287
AY Dra	5286
CM Dra	5252
DM Dra	5284
VV Eri	5287
EN Eri (=66 Eri)	5213
TZ Gem	5263
AV Gem	5263, 5287
BT Gem	5287
CW Gem	5287
EG Gem	5263
EL Gem	5287
FT Gem	5287
GM Gem	5263
HR Gem	5263
KQ Gem	5263, 5287
KV Gem	5263, 5287
OW Gem	5239
TT Her	5220
AH Her	5276
AK Her	5206, 5223, 5300
AM Her	5263
DH Her	5263
ES Her	5263
GU Her	5206
LV Her	5201
V342 Her	5287
V357 Her	5280
V502 Her	5263
V643 Her	5263
V719 Her	5263, 5287
V728 Her	5285
V789 Her	5287
V861 Her	5230
R Hya	5208
DE Hya	5263
GN Hya	5287
SW Lac	5255, 5300
CG Lac	5263
EL Lac	5287
EV Lac	5256
EX Lac	5263
GH Lac	5263, 5287
HW Lac	5263
HX Lac	5263, 5287
IP Lac	5263
KO Lac	5263, 5287
LU Lac	5263, 5287
NR Lac	5263, 5287
NS Lac	5263
V344 Lac	5263
Y Leo	5263
RW Leo	5287
UU Leo	5263
UV Leo	5206
VZ Leo	5263
XZ Leo	5230
AD Leo	5272
BL Leo	5263, 5287
BW Leo	5263, 5287
CE Leo	5263
EX Leo	5258
Z Lep	5287
AH Lyn	5263, 5287
AH Lyr	5263
DT Lyr	5287
DU Lyr	5263
DZ Lyr	5263
FH Lyr	5263
GZ Lyr	5263
IP Lyr	5263
KT Lyr	5287
MN Lyr	5287
PY Lyr	5263, 5287
V361 Lyr	5263, 5287
V401 Lyr	5263
V404 Lyr	5230, 5263
V412 Lyr	5287
V417 Lyr	5287
V429 Lyr	5287
V431 Lyr	5287
V474 Lyr	5218
V563 Lyr	5287
VX Mon	5263, 5287
AY Mon	5263
BH Mon	5287
CP Mon	5287
GU Mon	5287

Star	IBVS No.
V396 Mon	5287
V524 Mon	5287
V532 Mon	5263, 5287
V577 Mon	5272
CH Oph	5297
V648 Oph	5225
V839 Oph	5220, 5236
V981 Oph	5287
CQ Ori	5287
DZ Ori	5287
EG Ori	5263, 5287
FH Ori	5263
FU Ori	5214
GU Ori	5263, 5287
OS Ori	5287
QV Ori	5263
V645 Ori	5263
V648 Ori	5263
BN Peg	5220
BX Peg	5220
BY Peg	5263
CC Peg	5263
CE Peg	5263
EY Peg	5263
V357 Peg	5282
WY Per	5263
CH Per	5287
DK Per	5263
EQ Per	5287
FW Per	5287
II Per	5263, 5287
PS Per	5287
QU Per	5263
V366 Per	5263
V434 Per	5287
AS Psc	5266
DW Psc	5248
VW Pyx	5218
V Sge	5287
UU Sge	5218
WZ Sge	5216, 5221
WZ Sge-33 [HH95]	5216
DK Sge	5263
EI Sge	5263
FL Sge	5263
V354 Sge	5270
GM Sgr	5291
V4641 Sgr	5274, 5289, 5291
V701 Sco	5293
V893 Sco	5262
AV Scl	5290
BI Ser	5263
CX Ser	5263
NN Ser	5218
AH Tau	5230
AP Tau	5287
AQ Tau	5263
EN Tau	5263
EQ Tau	5230
ES Tau	5263
V407 Tau	5263
V Tri	5287
RS Tri	5287
RV Tri	5287
ST Tri	5287
UX Tri	5210
TU UMa	5273
UX UMa	5249, 5263
VV UMa	5263
BE UMa	5218
DW UMa	5206
ER UMa	5262
FG UMa	5227
AW Vir	5263
AX Vir	5263, 5287
BH Vir	5222, 5287
DY Vir	5263
GR Vir	5300
HY Vir	5241
NN Vir	5300
RR Vul	5287
AW Vul	5263
AX Vul	5263
BG Vul	5263
BI Vul	5263
BK Vul	5263
BM Vul	5263

Star	IBVS No.
BT Vul	5263
BU Vul	5220
FF Vul	5263, 5287
FM Vul	5263
FR Vul	5263
FY Vul	5253
GI Vul	5263
GV Vul	5263
NO Vul	5263
[HH95] WZ Sge-33	5216
1RXS J232953.9+062814	5233
2 MASSI J 1944495-004656	5288
AC 2000 2052114	5233
AC 2000 2052132	5233
ADS 2594B	5261
AN 540-1936	5294
Antipin's Variable 74	5265
BD −01°2777	5241
BD +17°1281	5239
BD +24°2475	5235
BD +38°4092	5294
BD +38°4098	5294
BRH V17	5203
BRH V28	5203
BRH V65	5260
BRH V100	5260
BRH V102	5260
BV 238	5207
BV 338	5286
CCDM 18535+7547	5202
ES 560	5261
ES 560A	5261
ES 560B	5261
EUVE J2244−15.9	5281
GSC 00279−00287	5299
GSC 00279−00321	5299
GSC 00279−00536	5299
GSC 00477−00889	5260
GSC 00477−01815	5260
GSC 00477−03346	5203
GSC 00477−03656	5203

Star	IBVS No.
GSC 00503−00328	5211
GSC 00503−00388	5211
GSC 00503−00700	5211
GSC 00503−00802	5211
GSC 00503−01318	5211
GSC 00503−01409	5211
GSC 00503−01511	5211
GSC 00503−02279	5211
GSC 00614−00524	5248
GSC 00614−00592	5248
GSC 00614−01209	5248
GSC 00628−00290	5219
GSC 00650−00475	5234
GSC 00650−00769	5234
GSC 00669−00620	5260
GSC 00669−00674	5260
GSC 00983−00566	5231
GSC 00983−01044	5231
GSC 00983−01313	5231
GSC 01058−00287	5275
GSC 01062−00024	5275
GSC 01123−01704	5203
GSC 01123−01424	5203
GSC 01123−01430	5203
GSC 01332−00578	5239
GSC 01343−01988	5277
GSC 01343−02222	5277
GSC 01343−02414	5277
GSC 01377−00370	5260
GSC 01377−00969	5260
GSC 01609−00518	5270
GSC 01609−00690	5270
GSC 01609−00944	5270
GSC 01621−02192	5221
GSC 01851−00320	5271
GSC 01851−00579	5271
GSC 01877−00086	5278
GSC 01877−00245	5278
GSC 01877−00864	5278
GSC 01996−00437	5269
GSC 02001−00300	5269
GSC 02004−00784	5269
GSC 02035−00175	5295
GSC 02038−01381	5292
GSC 02038−01473	5292
GSC 02038−01730	5292

Star	IBVS No.
GSC 02040−01361	5295
GSC 02084−00693	5228
GSC 02084−00777	5228
GSC 02084−01119	5228
GSC 02084−01154	5228
GSC 02118−00221	5205
GSC 02118−00292	5205
GSC 02118−00294	5205
GSC 02118−00297	5205
GSC 02118−00299	5205
GSC 02151−00197	5242
GSC 02294−00916	5210
GSC 02294−01202	5210
GSC 02294−01576	5210
GSC 02336−00281	5287
GSC 02579−01125	5295
GSC 02580−02086	5295
GSC 02605−00545	5229
GSC 02605−00693	5229
GSC 02605−00791	5229
GSC 02632−00319	5232
GSC 02673−00525	5268
GSC 02673−02950	5268
GSC 02763−00683	5255
GSC 02763−00878	5255
GSC 02866−01819	5244
GSC 02866−01866	5244
GSC 02899−00521	5267
GSC 02899−01257	5267
GSC 02899−01786	5267
GSC 02899−02149	5267
GSC 03026−01046	5269
GSC 03104−01384	5232
GSC 03151−00480	5242
GSC 03151−00600	5242
GSC 03151−00633	5242
GSC 03152−01283	5294
GSC 03152−25322	5294
GSC 03152−50721	5294
GSC 03154−00004	5204
GSC 03154−01519	5204
GSC 03215−01586	5255
GSC 03215−00906	5255
GSC 03429−00621	5244
GSC 03429−01027	5244
GSC 03429−01645	5244
GSC 03440−00085	5232
GSC 03449−00929	5232
GSC 03551−01708	5285
GSC 03551−01748	5285
GSC 03822−01056	5206
GSC 03872−01194	5286
GSC 03948−01963	5247
GSC 04281−01972	5265
GSC 04456−01244	5207
GSC 04456−01751	5207
GSC 04457−00016	5207
GSC 04504−00583	5212
GSC 04504−00663	5212
GSC 04686−02077	5257
GSC 04686−02303	5257
GSC 04686−02315	5257
GSC 05145−00383	5288
GSC 05145−00716	5288
GSC 05145−01789	5288
Had V67	5225
HD 001909	5290
HD 003346	5209
HD 004078	5290
HD 011547	5238
HD 011572	5238
HD 011979	5217
HD 012273	5238
HD 012582	5238
HD 032964	5212
HD 046005	5258
HD 078846	5258
HD 081282	5258
HD 084345	5209
HD 089546	5227
HD 092511	5258
HD 092648	5258
HD 093077	5258
HD 112975	5209
HD 114125	5241
HD 123232	5209
HD 145895	5209
HD 153345	5279
HD 155038	5209
HD 175589	5209
HD 183556	5202

Star	IBVS No.
HD 191616	5211
HD 191674	5211
HD 196643	5209
HD 201298	5209
HD 208530	5209
HD 215341	5281
HD 215427	5209
HD 216598	5255
HD 220954	5233
HD 252611	5278
HD 275525	5244
HD 275605	5244
HD 317844	5293
HDE 258878	5239
HIC 16563	5261
HIP 09234	5217
HIP 09644	5238
HIP 52580	5258
HIP 79886	5258
HIP 85985	5293
HIP 95154	5202
HR 7199	5202
HV 5469	5275
IRAS 15374−5711	5286
IRAS 18160−2529	5274
IRAS 19422−0054	5288
J 232954.38+062810.2 [WXD99]	5233
NSV 00616	5210
NSV 00786	5249
NSV 02852	5278
NSV 12223	5207
NSV 12364	5288
PG 1550+131	5218
ROTSE1 J131424.16+271131.6	5269
ROTSE1 J133638.49+281139.0	5269
ROTSE1 J133659.37+265247.6	5269
ROTSE1 J133726.05+373458.4	5269
ROTSE1 J155918.57+275214.9	5295
ROTSE1 J160014.54+351228.4	5295
ROTSE1 J160153.55+245217.7	5295
ROTSE1 J161458.52+301646.1	5295
ROTSE1 J165241.80+124905.2	5231
ROTSE1 J172601.97+304710.4	5229
ROTSE1 J174103.55+273429.1	5228
ROTSE1 J182434.81+381740.5	5232
ROTSE1 J182943.22+280955.2	5205
ROTSE1 J183053.78+340814.1	5232
ROTSE1 J184654.98+450054.7	5232
ROTSE1 J185835.38+500928.9	5232
ROTSE3 J015118.59−022300.1	5226
RXJ 201043+045449	5211
S 04350 Her	5280
S 05341	5275
S 09193	5278
S 10948	5275
SA 113	5294
SAO 009404	5202
SAO 070047	5294
SAO 070055	5294
SAO 073069	5255
SAO 075119	5238
SAO 095777	5239
SAO 139131	5241
SAO 139174	5241
SAX J1819.3−2525	5274, 5289, 5291
SBS 1522+599	5284
SN 1997ef	5283
SN 1998bw	5283
SN 2002ap	5264, 5283
SVS 2426	5284
TYC 2076 10421	5201
TYC 2125 00895	5233
USNO 0900−17903132	5211
USNO 0900−20419578	5233
USNO−A2.0 0825.16788287	5288
USNO−A2.0 0825.16831668	5288
USNO−A2.0 0825.16834586	5288
USNO−A2.0 1050.13998661	5270
USNO−A2.0 1050.14001553	5270
USNO−A2.0 1500.09980530	5265
USNO−A2.0 1500.09984515	5265
USNO−A2.0 1500.09991623	5265
YALO J181900.9−252412	5289

Star	IBVS No.
YALO J181907.8−252715	5289
YALO J181910.6−252739	5274
YALO J181911.0−252320	5291
YALO J181916.8−252336	5274
YALO J181921.5−252538	5291
YALO J181924.4−252554	5289
YALO J181924.8−252457	5289
YALO J181936.7−252553	5291

Minima of Binary Stars	5224
$BV(RI)_C$ Observations of Some Dwarf Novae	5240
Times of Minima of Eclipsing Binaries	5251
CCD Times of Minima of Faint Eclipsing Binaries III.	5263
CCD Times of Minima of Faint Eclipsing Binaries in 2000	5287
Photoelectric Minima of Selected Eclipsing Binaries and Maxima of Pulsating Stars	5296
Coordinates and Identifications of Harvard Variables	5298

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THE PERIOD OF LV HERCULIS REVISITED

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In a recent note (Torres 2000) the orbital period of LV Her (TYC 2076 − 1042 − 1; $17^{h}35^{m}32\overset{s}{.}4$, $+23°10'31''$, J2000; SpT. F9, $V = 10.9$) was reported to be 18.13120 days based on radial velocity measurements made at the Harvard-Smithsonian Center for Astrophysics (CfA). This seemed to solve the long-standing mystery about the true period of this binary, claimed originally to be 2.634 days by Zessewitsch (1944) and later revised to 5.2674 days by Zessewitsch (1954). It also seemed to solve the problem posed by the preliminary spectroscopic orbit obtained by Popper (1996), with an even longer period of 9.218 days. That orbit implied a total mass for the system of only $\sim$1.0 $M_{\odot}$, which is too small for two very similar main-sequence stars of spectral type F9 or G0 in an eclipsing system.

Although the new 18.13120-day period gave a good fit to the CfA radial velocities, the report by Torres (2000) mentioned the lingering difficulty that the ephemeris did not agree with the few published times of minimum for LV Her. Continued spectroscopic observations at CfA eventually hinted at a problem with the orbit presented by Torres (2000), as additional velocity measurements began to show large residuals. In particular, new observations on the steeper portions of the velocity curves that were not well covered by the original data deviated considerably from the predictions.

Photometric (CCD) observations in the visual band by one of us (CHSL) with a robotic telescope at the Univ. of Arkansas also indicated discrepancies in the times of eclipse compared to the ephemeris by Torres (2000). It was soon found that a slight adjustment to the period of about +0.3 days gave an excellent fit to all the spectroscopic observations, as well as to the new and published eclipse timings.

Subsequently, numerous times of eclipse have been recovered from archival photographic plates going back nearly a century that are extremely valuable for confirming and improving the period of LV Her. Blue-sensitive patrol plates from the AC series at the Harvard College Observatory were measured by PRG using a sequence of steps to estimate changes in brightness. Similar material from the Sky Survey plates at the Sonneberg Observatory was measured by RD. In addition, a number of times of minimum have been derived from visual observations over the last decade by MEB. All of these observations are listed in Table 1, along with the CCD measurements mentioned above and also the historical times of minimum from the literature. A weighted least-squares adjustment to these data was performed by adopting typical uncertainties of 0.046 days and 0.012 days for the photographic and visual minima (determined by iterations), 0.004 days for the first two photoelectric minima, and 0.0008 days for the final more accurate timing. The ephemeris obtained for LV Her is:

$$\text{Min I} = 2{,}452{,}066.66949(95) + 18.4359348(56) \cdot E$$
$$\text{Min II} = 2{,}452{,}064.1673(29) + 18.4359348(56) \cdot E.$$

where the figures in parenthesis represent the uncertainty in the last digits. Separate solutions for a period from the primary and secondary minima show no evidence for apsidal motion.

Table 1. Times of minimum for LV Her (HJD−2,400,000).

HJD	Type[1]	Obs[2]	Cycle	O−C	Ref[3]	HJD	Type	Obs	Cycle	O−C	Ref
15929.712	2	pg	−1960	−0.0231	1	37906.406	?	pg	−768	(−1.4956)	4
16224.798	2	pg	−1944	+0.0879	1	38147.573	1	pg	−755	+0.0043	2
16669.658	1	pg	−1920	−0.0467	1	38587.449	2	pg	−731	−0.0500	2
17351.799	1	pg	−1883	−0.0353	1	40744.498	2	pg	−614	−0.0053	2
18605.473	1	pg	−1815	−0.0049	1	41060.502	1	pg	−597	+0.0556	2
23601.681	1	pg	−1544	+0.0648	1	41982.251	1	pg	−547	+0.0078	2
24062.505	1	pg	−1519	−0.0096	1	42664.347	1	pg	−510	−0.0258	2
26032.643	2	pg	−1412	+0.0156	2	46001.268	1	pg	−329	−0.0090	2
26032.644	2	pg	−1412	+0.0166	1	46941.483	1	pg	−278	−0.0266	2
26090.482	1	pg	−1409	+0.0146	2	47381.384	2	pg	−254	−0.0559	2
26219.577	1	pg	−1402	+0.0581	1	48100.425	2	pg	−215	−0.0163	2
26901.699	1	pg	−1365	+0.0505	1	48487.60	2	v	−194	+0.0041	5
27212.514	2	pg	−1348	−0.0132	2	48508.60	1	v	−193	+0.0359	5
27636.462	2	pg	−1325	−0.0917	2	48545.52	1	v	−191	+0.0840	5
27657.429	1	pg	−1324	−0.0928	2	48745.70	2	v	−180	+0.0010	5
28281.830	2	pg	−1290	+0.0186	1	48948.50	2	v	−169	+0.0057	5
30254.522	2	pg	−1183	+0.0655	1	49098.540	1	pg	−161	+0.0260	2
31268.42	2	v	−1128	−0.0129	3	49206.61	2	v	−155	+0.0126	5
31289.35	1	v	−1127	−0.0510	3	49667.49	2	v	−130	−0.0058	5
31326.29	1	v	−1125	+0.0171	3	49688.48	1	v	−129	+0.0161	5
31342.16	2	v	−1124	−0.0166	3	49925.65	2	v	−116	+0.0511	5
34626.332	1	pg	−946	+0.0268	2	52008.85	2	pe	−3	−0.0095	6
37444.539	2	pg	−793	+0.0680	2	52045.74	2	pe	−1	+0.0086	6
37869.519	?	pg	−770	(−1.5107)	4	52066.6993	1	pe	0	−0.0002	6

[1]Type: 1 = primary eclipse, 2 = secondary eclipse.
[2]Obs: pg = photographic, v = visual, pe = photoelectric.
[3]Ref: 1 = Guilbault (Harvard plates), 2 = Diethelm (Sonneberg plates), 3 = Zessewitsch (1954), 4 = Huth (1964), 5 = Baldwin (visual), 6 = Lacy (CCD)

Only the two photographic timings by Huth (1964) give large residuals of ∼1.5 days (indicated in parentheses in the table), and were not included in the fit. Inspection of the original plates from the Sonneberg Observatory by one of us (RD) revealed an anomalously bright comparison star on both dates (which is possibly variable) as well as a plate defect on the second date, which make these measurements highly suspect.

The large eccentricity ($e = 0.61$) and peculiar orientation of the orbit of LV Her result in a secondary minimum that does not occur midway in phase between two primary minima, but instead at phase 0.8626 ± 0.0032. The separation of only 0.137 from the primary eclipse has no doubt contributed to the confusion of the early observers and to the difficulty in establishing the period. The new value, which is essentially double the period proposed by Popper (1996), along with the spectroscopic observations from CfA implies minimum masses of 1.20 $M_\odot$ and 1.17 $M_\odot$ for the components, in good agreement with the spectral type. The apparently synchronous rotation of the stars (see Torres 2000) and the eccentric orbit make this system potentially very interesting for a comparison with current theories of tidal evolution. Spectroscopic observations at CfA as well as photometric (CCD) observations are being continued, and a detailed investigation of the binary will be the subject of future paper.

PRG would like to thank Alison Doane, acting curator of the Astronomical Photograph Collection at the Harvard College Observatory, for the use of the plates. RD wishes to thank the administrative staff of the Sonneberg Observatory for the hospitality provided during his stay there.

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PHOTOELECTRIC OBSERVATIONS OF THE COMPLEX LOW-AMPLITUDE RED VARIABLE, UX Dra

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UX Dra (HD 183556, SAO 9404, HIP 95154) is a luminous carbon star with Tc (Little et al. 1987) and has a spectral type of C5 II. According to the Combined GCVS (Kholopov et al. 1998), following earlier editions, it is an SRa variable with a period of 168 days. From times of minimum, Vetesnik (1983) found a constant lengthening of the period but more extensive photographic data suggested that this was part of a long term cycling of the period between 155 and 185 days, over about 5000 days. At the end of each cycle the period would apparently glitch back to the lower value. From an analysis of the historical visual data Kiss et al. (1999) found UX Dra to be a biperiodic variable, in common with about half of their sample, with periods of 176 ± 1 and 317 ± 2 days.

UX Dra has been observed almost continuously since mid-1994 as part of a programme to investigate known and suspected, small-amplitude red variables. Early observations covering the first two years data have been discussed previously by Lloyd & West (1996, Paper I). The observations were made using an SSP3 photometer and nominal V filter on a 20-cm Newtonian reflector using a $2'$ aperture. Each observation consisted of 2 or 3 sets of 3×10 second integrations. Differential extinction corrections were applied but these are small and are comparable to the errors. Details of the comparison stars are given in Table 1. The photometric data are taken from the compilation of Mermilliod et al. (1997) and are very similar to the values derived from Hp, V_T and B_T. HR 7199 = CCDM 18535+7547 is a close double star with a separation of $6''$ and magnitude difference of $0\overset{m}{.}6$ at V. The revised magnitudes of the comparison stars are now in much better agreement with the observed magnitude difference, $\Delta V = -0\overset{m}{.}231 \pm 0\overset{m}{.}017$ than was the case in Paper 1.

The new V-band light curve of UX Dra is shown in Figure 1 and covers about four times the period reported in Paper I. Consequently the general behavior of the star is

Table 1: UX Dra comparison stars information

Comparison	V	$B-V$	Sp
HR 7199 = HD 176795	6.33	0.01	A1 V
HR 7247 = HD 178089	6.55	0.38	F2 V

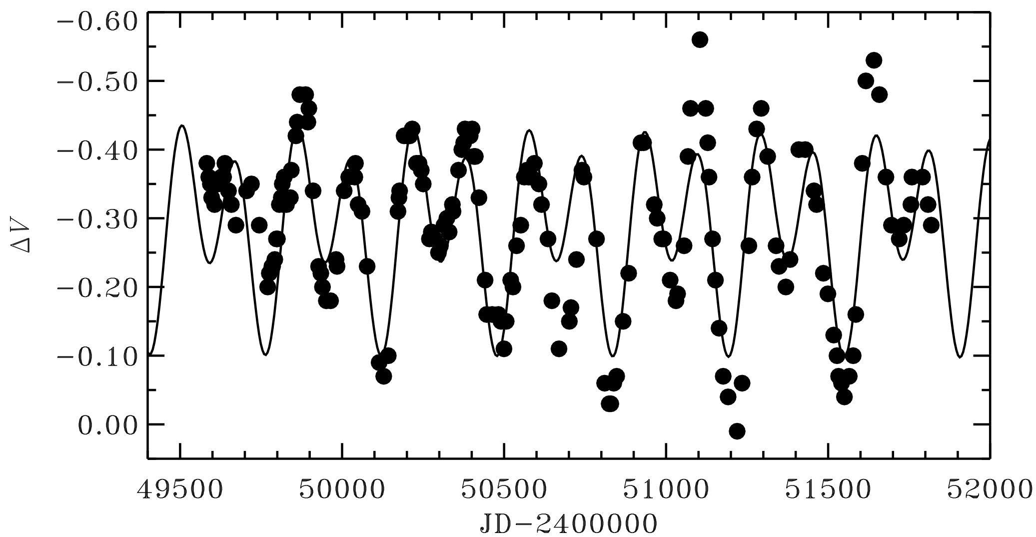

Figure 1. The V-band light curve of UX Dra from 1994 – 2000 relative to HR 7199, with the 178 and 359 day period fit over plotted.

rather clearer, but no simpler. The full range of variation during this time is nearly $0^{\rm m}_{.}6$, but the vast majority of the light curve covers less than $0^{\rm m}_{.}3$. The periodogram shows a main period of 178 days with a second period of approximately twice this value. There is very little difference in the fit to the light curve if the shorter period is treated as the first harmonic of the longer period, however, as will be seen the relationship between them is not fixed. A two-period fit to the data yields periods of 178 ± 1 and 359 ± 3 days and after these have been removed a period of $\sim$ 665 days, and a long-term trend, remain above the general noise level. Including this additional period makes no obvious improvement in the fit to the light curve. Of the two principal periods the shorter one is very similar to that found in the historical visual data but the longer period is rather different, 359 as opposed to 317 days.

Not surprisingly the near-harmonic two-period fit produces a light curve with oscillating maxima and minima. The phasing of the fit throughout this time is relatively good but it does occasionally wander off, and there are clearly very significant deviations in amplitude of both the maxima and minima. Also, as was reported in Paper I, but is not clearly visible in Figure 1, the behavior at the start of the observations is rather different. The amplitude is much lower, $< 0^{\rm m}_{.}1$, and the characteristic time scale of the variations is $\sim$ 75 days, which is close to the second harmonic of the long period. The reduction in amplitude at this time is typical of the beating together of two periods but the time scale of the variations should not change. It is possible that other, low-amplitude variations may be revealed at these times, but if they are always present then they should also appear in the periodograms, and there are no consistent features above the noise at periods < 100 days.

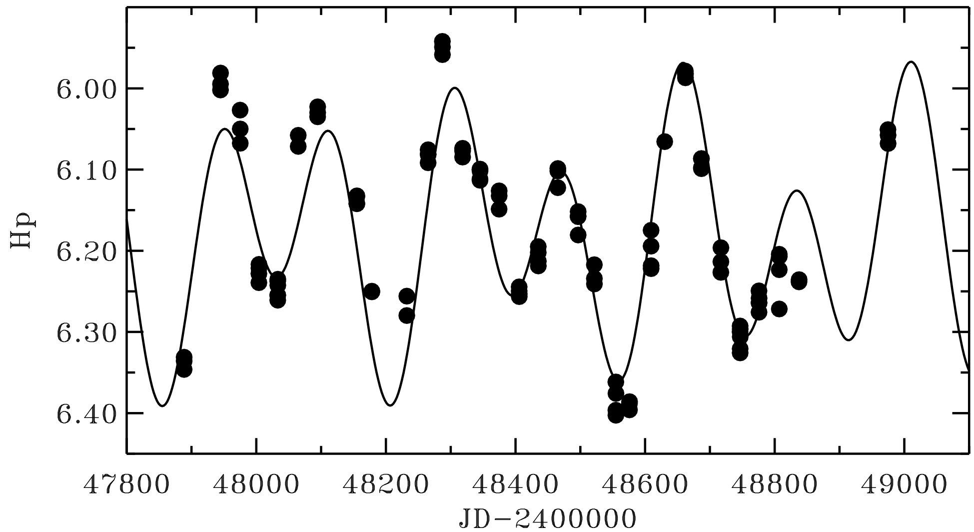

Figure 2. The Hipparcos light curve of UX Dra from 1990 – 1992, with the 179 and 322 day period fit over plotted.

Hipparcos has also observed UX Dra, for approximately three years about two years prior to the start of the V-band observations. The Hipparcos light curve is shown in Figure 2 and the general behavior is very similar to that in Figure 1. The periodogram of the Hipparcos data also reveals similar periods; the best fit is with 179 ± 1 and 322 ± 5 days. The shorter period is practically identical to that of the V-band data and both are close to the values found in the historical visual data. Any remaining periods are dominated by a long-term trend in the data.

The two data set have been combined by subtracting their respective means, which are also very close to the zero points of their two-period fits. The combined data yields best fit periods of 175 ± 1 and 334 ± 2 days but the periodogram does not offer an unambiguous choice of second period. It also shows other periods remaining above the noise after the principal periods have been removed, the two most prominent being at 186 and 301 days. Interestingly, when these two periods are included in the fit to the data, their amplitudes are essentially identical to that of the 334 day period, at $0\overset{\mathrm{m}}{.}05$. The amplitude of the dominant period, 175 days, is $0\overset{\mathrm{m}}{.}10$. Another curious feature of including these additional two periods is that the frequency spacing of the longer and shorter pairs is identical, 0.00032 cycles day^{-1}, corresponding to 3125 days. Similarly, the alternative pairings give frequency spacings of 0.00238 cycles day^{-1}, corresponding to 420 days. Neither of these time scales have any apparent correspondence in the data, nor do the periods appear clearly in the periodograms of the individual data sets, although the 301-day period does appear weakly in the V-band data. The significance, or otherwise, of these additional periods and the frequency spacings they generate, is at present unclear, but tests have shown that they are not due to the misalignment of the two data sets.

UX Dra appears to have two dominant periods but it is clear that a stationary solution, even with several additional periods will not adequately describe the light curve. Shifting periods, and phase changes, are a recognized feature of long-period variable light curves

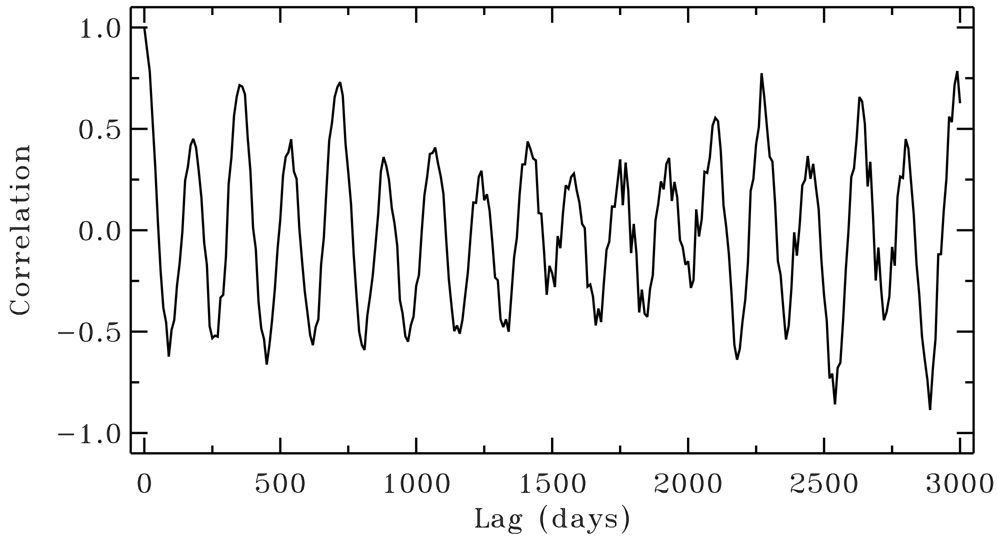

Figure 3. The autocorrelation function of the combined data set showing the stability of the 175 day period.

but within the data studied here the shorter period, 175 days, seems to have been the more stable. The autocorrelation function of the combined data set is shown in Figure 3 and clearly demonstrates the stability of this period over eleven years. On the other hand the longer period does differ between the two data sets, and the long term visual value. It seems likely that the interaction of the two periods, along with some instability can account for the changing behavior seen by Vetesnik (1983). However, variation of the longer period will not account for the large, and relative short time scale, of the amplitude variations, which cause the main discrepancy between the observed and modelled light curve. These seem to be on the time scale of the 175 day period or shorter, as do the variations at the beginning of the V-band data described earlier. While it may possible to explain some of the residuals by shifts in period or phase, the main difficulty in describing the large excursions in amplitude in the context of multiperiodic variations, is the lack of any periods < 100 days.

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ON THE VARIABILITY OF V1538 Aql (Brh V17) AND GSC 1123.1704 (Brh V28)

(BAV MITTEILUNGEN NO. 140)

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VAR 1:

Name of the object:
V1538 Aql, GSC 0477.3880

Equatorial coordinates:	**Equinox:**
R.A.= $19^h24^m36^s.4$ **DEC.=** $06°31'28''$	2000

Comparison star(s):	GSC 0477.3656, $V \approx 12^m.1$

Check star(s):	GSC 0477.3346

Type of variability:	RRc

VAR 2:

Name of the object:
GSC 1123.1704

Equatorial coordinates:	**Equinox:**
R.A.= $21^h28^m30^s.2$ **DEC.=** $10°45'23''$	2000

Comparison star(s):	GSC 1123.1430, $V \approx 12^m.8$

Check star(s):	GSC 1123.1424

Type of variability:	WUMa

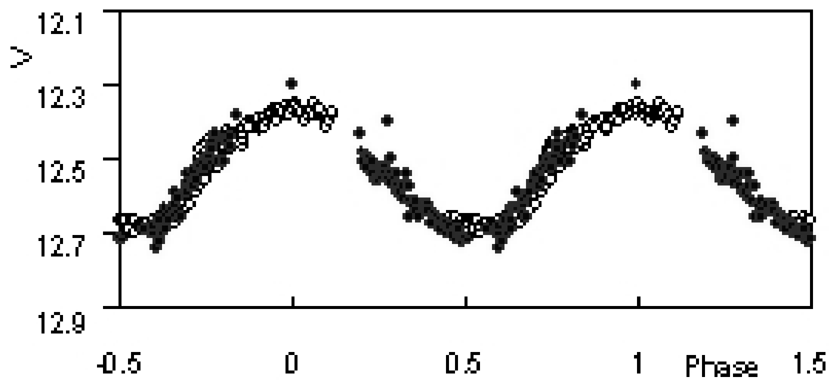

Figure 1. The phase diagram of V1538 Aql assuming that the comparison star GSC 0477.3656 has V=12$^{\mathrm{m}}$.1. The CCD observations of K. Bernhard (open circles) and W. Moschner (filled circles) are folded with the ephemeris given in the text

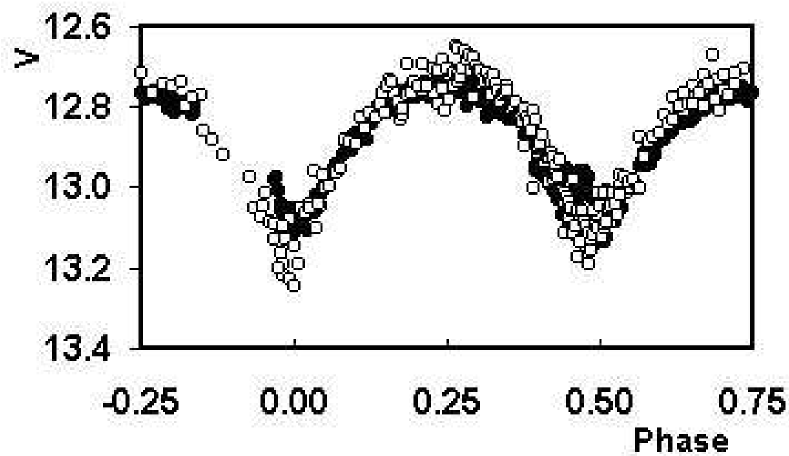

Figure 2. The phase diagram of GSC 1123.1704 assuming that the comparison star GSC 1123.1430 has V = 12$^{\mathrm{m}}$.8, observations of K. Bernhard (open circles) and W. Moschner (filled circles)

Observatory and telescope:
W. Moschner: Private observatory, 32-cm Ritchey–Chrétien telescope; K. Bernhard: Private observatory, 20-cm Schmidt–Cassegrain telescope

Detector:	W. Moschner: SBIG ST-6 camera; K. Bernhard: Starlight Xpress SX camera

Filter(s):	W. Moschner, K. Bernhard: None

Transformed to a standard system:	No

Availability of the data:
Upon request

Remarks:

The variability of V1538 Aql and GSC 1123.1704 has been found as part of a programme to discover and classify new variables using CCD observations of selected fields on the edge of the northern Milky Way (Bernhard & Lloyd 2000). Further observations of V1538 Aql were performed on 2 nights in October 1999 (W. Moschner) and on 3 nights in October 2001 (K. Bernhard). GSC 1123.1704 was observed on 8 nights between October and November 1999 (W. Moschner) and on 9 nights between October 1999 and October 2001 (K. Bernhard).
The ephemeris were calculated using the "Phase Dispersion Minimization" method. The light curves show variations of an RRc star for V1538 Aql and of a WUMa star for GSC 1123.1704. These types and periods are partly different form those given in the announcement of the discovery (Bernhard & Lloyd, 2000):
V1538 Aql:

$$\begin{array}{rll} \mathrm{Max} = \mathrm{HJD}\ 2452202.26 & + & 0\overset{\mathrm{d}}{.}267937 \times E. \\ \pm 1 & & \pm 4 \end{array} \qquad (1)$$

GSC 1123.1704:

$$\begin{array}{rll} \mathrm{MinI} = \mathrm{HJD}\ 2451484.322 & + & 0\overset{\mathrm{d}}{.}43611 \times E. \\ \pm 8 & & \pm 1 \end{array} \qquad (2)$$

Acknowledgements:

This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France.

Reference:

Bernhard, K., Lloyd, C., 2000, *IBVS*, No. 4920

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NEW ELEMENTS FOR THE ECLIPSING BINARY V1036 Cyg

(BAV MITTEILUNGEN NO. 141)

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Name of the object:
V1036 Cyg

Equatorial coordinates:	**Equinox:**
R.A.= $20^h08^m04^s$ **DEC.=** $40°43'42''$	2000

Observatory and telescope:
Agerer F.: Private observatory, 20-cm SCT;
Frank, P.: Private observatory, 10-cm astrograph;
Moschner, W.: Private observatory, 32-cm Ritchey-Chrétien telescope

Detector:	SBIG ST6 cameras in all cases

Filter(s):	none

Comparison star(s):	GSC 3154:0004

Check star(s):	GSC 3154:1519

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	EA

Table 1: Observed times of minima for V1036 Cyg, epochs and residuals computed with respect to the linear ephemeris derived in this paper.

Nr	JD hel. 2400000+	Weight	Type*	Epoch	O–C	Observer
1	33894.440	0	P	−5901.0	+0.517	Romano
2	36808.374	1	P	−4853.0	+0.001	Romano
3	37189.377	1	P	−4716.0	+0.012	Romano
4	45646.240	1	P	−1675.0	−0.036	Moschner
5	50304.3939	10	E	0.0	+0.0039	Frank/Moschner
6	50315.5124	10	E	4.0	−0.0015	Frank/Moschner
7	50361.3948	10	E	20.5	−0.0050	Moschner
8	50396.1937	1	P	33.0	+0.0319	Moschner
9	50582.4853	10	E	100.0	−0.0011	Moschner
10	50671.4780	10	E	132.0	+0.0008	Frank/Moschner
11	50696.5038	10	E	141.0	−0.0021	Frank/Moschner
12	50717.3661	10	E	148.5	+0.0030	Moschner
13	50749.3455	10	E	160.0	+0.0013	Moschner
14	51045.5157	10	E	266.5	−0.0011	Moschner
15	51045.5187	10	E	266.5	+0.0019	Agerer
16	51376.4540	10	E	385.5	+0.0025	Moschner
17	51426.5061	10	E	403.5	−0.0028	Moschner
18	51433.4610	10	E	406.0	−0.0003	Moschner

* P denotes photographic plate minima and E CCD measured minima

Remarks:

V1036 Cyg was discovered by Weber (1962) and classified as an eclipsing binary. In the course of a sky survey in the field of Gamma Cygni, Romano (1969) found the star weak on three plates taken with the Schmidt-telescope of Padua-Asiago Observatory. No elements could be derived. In the GCVS (Kholopov et al. 1985) the variable is listed with a period of $0\overset{d}{.}74412$. In 1994 we put V1036 Cyg on our observing program. Soon it was clear, that the period given in the GCVS is a spurious one (1 cycle/day alias) with the relation:

$$\frac{1}{\mathrm{P_{GCVS}}} - \frac{1}{\mathrm{P}} \approx \frac{1}{1\mathrm{d_{sid}}} \qquad (1)$$

The primary and secondary minima have an amplitude of $0\overset{m}{.}75$ and $0\overset{m}{.}35$ respectively. The minimum times are calculated according to the Kwee–van Woerden method (Kwee, van Woerden 1956). A least squares fit to the data given in Table 1 led to the preliminary ephemeris:

$$\begin{array}{lll} \mathrm{Min\ I = HJD} & 2450304.3900 & +2\overset{d}{.}7809637 \times E \\ & \pm 4 & \pm 7 \end{array} \qquad (2)$$

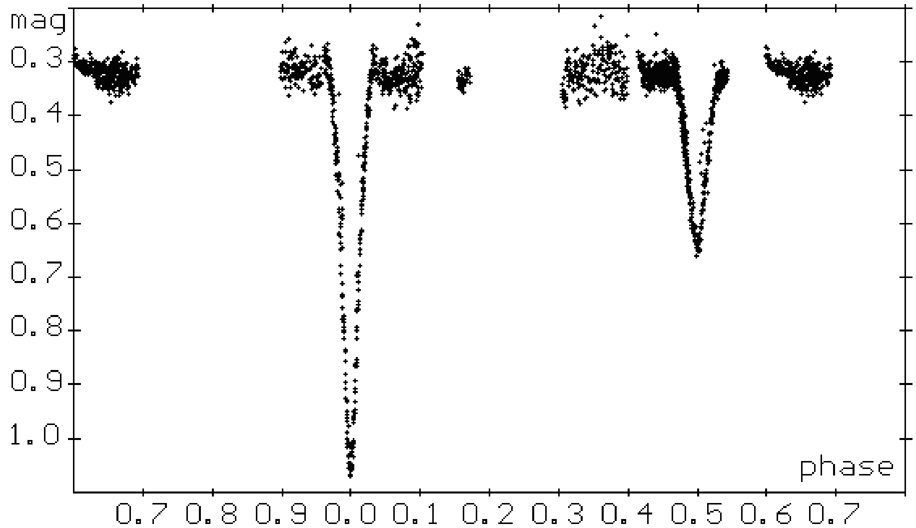

Figure 1. Differential light curve of V1036 Cyg

Acknowledgements:
This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France

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GSC 2118-00297: A NEW DOUBLE-MODE δ SCUTI VARIABLE

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The star GSC 2118-00297 (= ROTSE1 J182943.22+280955.2; $\alpha_{2000} = 18^h29^m43^s$; $\delta_{2000} = +28°09'.9$) was announced by the ROTSE1 (Robotic Optical Transient Search Experiment 1) survey (Akerlof et al., 2000) to be a δ Scuti variable with a period of $0\overset{d}{.}170407$ in the approximate magnitude range 12.6-12.9.

The star was observed at Beersel Hills Observatory on six nights between August and October 2001. A total of 760 data points were obtained during 15.4 hours of photometry. The instrument used was a 0.40-m telescope, equipped with a ST7E CCD camera. No filter was used. The exposure times varied between 50 and 90 seconds. The images were reduced with the aperture photometry procedure of the Mira AP software package†.

The brightness of the variable was measured with respect to GSC 2118-00221, having a colour ($\Delta(B-V)$= 0.19) closest to the variable, from among neighbouring stars. GSC 2118-00299 ($\Delta(B-V)$= 0.56) and GSC 2118-00292 ($\Delta(B-V)$= 0.26) served as check stars. The instrumental values of $\Delta(B-V)$ were determined from images in B and V light, using a filterset following Bessel's specifications. The nightly standard deviation of the differences in unfiltered magnitudes between the comparison and the first check star averaged $0\overset{m}{.}012$, and $0\overset{m}{.}023$ for the second check star. The check stars respectively have an instrumental magnitude of −0.90 and 0.64 with respect to the comparison star.

Using the Fourier analysis program Period98 (Sperl, 1998), the dominant frequency in the observations turned out to be 6.86961 c/d (see the Fourier periodogram in fig. 1), a one-day alias of the period given by Akerlof et. al. (2000). The peak to peak amplitude of this frequency is $0\overset{m}{.}30$. Frequencies below 3 c/d in the power spectrum were not considered as the density of observations at these frequencies is too low (the longest observing run being 4.2 hours on a total observation interval of 59 days).

After prewhitening for the fundamental frequency and its first harmonic (13.73923 c/d with an amplitude of $0\overset{m}{.}06$), a second frequency of 8.96848 c/d was found (see fig. 2), making this star a new double-mode δ Scuti star. The ratio of the first overtone to the fundamental period is 0.766, on the low end of the narrow observed range for this ratio in other double-mode δ Scuti stars (Petersen and Christensen-Dalsgaard, 1996). The amplitude of the second frequency is $0\overset{m}{.}03$, one tenth of the amplitude of the fundamental frequency, but well above the error bar on individual observations. These will be on the order of $0\overset{m}{.}012$ as GSC 2118-00297 is of similar brightness as the first check star.

†The Mira AP software is produced by Axiom Research Inc.

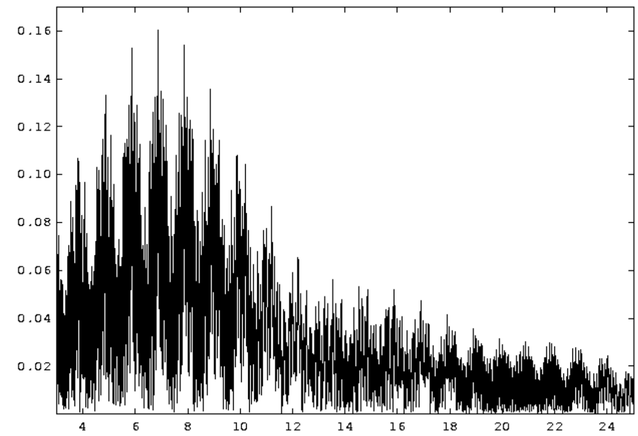

Figure 1. Fourier periodogram for GSC 2118-00297.

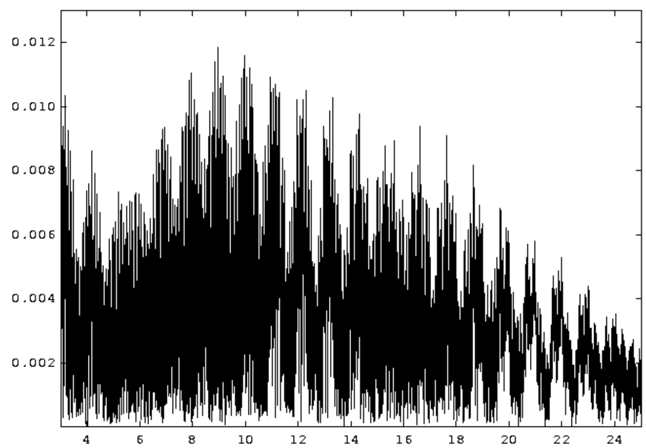

Figure 2. Fourier periodogram for GSC 2118-00297 after prewhitening for the fundamental period.

The following times of maxima have been determined (O-C values are listed with respect to the ephemeris derived below):

JD Hel.	E	O-C [d]	Observer
2451241.575	-6217	0.000	ROTSE1
2452146.518	0	0.001	PVC
2452175.334	198	-0.003	PVC
2452205.324	404	0.002	PVC

The first maximum in the list is obtained from a phase diagram of the ROTSE1 data (available through http://www.umich.edu/~rotse). From these maxima, the following ephemeris was derived:

$$\text{Max.} = \text{HJD } 2452146.516 + 0\overset{\text{d}}{.}1455591 \times E.$$
$$\pm 0.003 \pm 0.0000014$$

Fig. 3 shows the phased light curve from our data, folded with the fundamental period, and Fig. 4 the phase diagram of the first overtone (after prewhitening for the fundamental period and its first harmonic).

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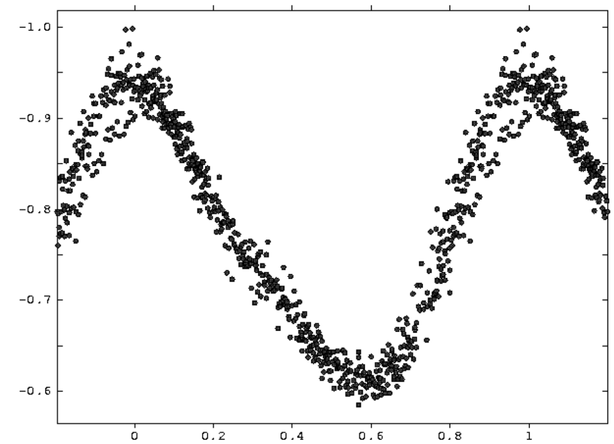

Figure 3. Phase diagram for the fundamental period of GSC 2118-00297.

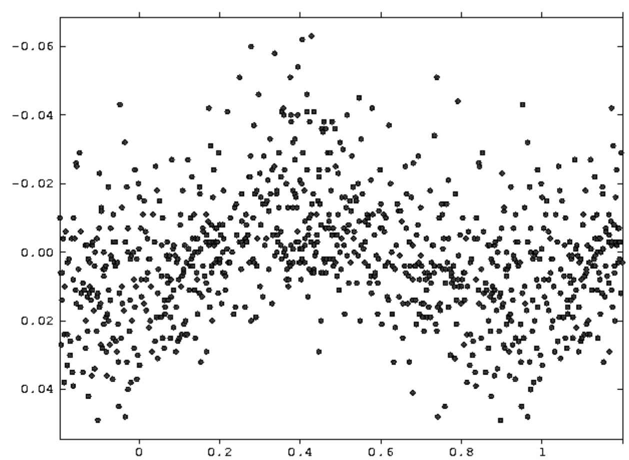

Figure 4. Phase diagram for the secondary period of GSC 2118-00297.

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NEW CCD TIMES OF MINIMA OF ECLIPSING BINARY SYSTEMS

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Observatory and telescope:
50-cm $f/8.4$ Ritchey–Chrétien telescope of the Baja Astronomical Observatory (Hungary)

Detector:	SBIG ST-7 CCD camera Apogee AP-7 CCD camera

Method of data reduction:
Reduction of the CCD frames was made with a customly developed IRAF[1] package.

Method of minimum determination:
The minima times were computed with parabolic fitting, and in some cases with linearized Pogson-method.

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
RT And	RS	23 11 10	+53 01 33	HD 218915	51463.2480	0.62892951	1
OO Aql	EW	19 48 13	+09 18 32	HD 187146	38613.2222	0.50678848	2
IM Aur	EA	05 15 30	+46 24 21	3358-0542*	38327.7974	1.2472891	3
				3358-1208**			
PV Cas	EA	23 10 03	+59 12 06	4010-1432	40227.4044	1.75046986	2
VW Cep	EW	20 37 21	+75 35 57	4585-2387	44157.4131	0.2783146	2
DL Cyg	EA	21 39 46	+48 32 24	SAO 51164	51038.48378	4.83039702	1
AK Her	EW	17 13 58	+16 21 01	1536-1834	42186.4600	0.42152201	2
GU Her	EA	16 32 05	+30 23 10	2581-2418	50983.46694	4.34320188	1
UV Leo	EA	10 38 21	+14 16 04	0845-0255	38440.72633	0.60008478	2
DW UMa	EA	10 33 53	+58 46 54	3822-0070	46229.00691	0.13660653	4
GSC 3822-1056	EW:	10 33 58	+58 52 16	3822-0070	50495.5212	0.30989069	5

Source(s) of the ephemeris:

1. present paper
2. Kholopov et al., 1985
3. Bartolini & Zoffoli, 1986
4. Bíró, 2000
5. Bíró & Borkovits, 2000

[1]IRAF is distributed by the National Optical Astronomical Observatories, operated by the Association of the Universities for Research in Astronomy, inc., under cooperative agreement with the National Science Foundation

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
RT And	52186.5154	1	I	R	−0.0015	Bor/AP7
OO Aql	52107.4975	2	I	R	0.0184	Bor+Kov/ST7
IM Aur	51848.396	1	I	-	−0.015	Bor/AP7*
	51871.471	4	II	-	−0.015	Bír/AP7**
	51891.4282	2	II	-	−0.0145	Bír/AP7**
	51909.5119	5	I	-	−0.0165	Bor/AP7**
	51919.4885	6	I	-	−0.0182	Bír/AP7**
	52189.5265	8	II	R	−0.0183	Bor/AP7**
PV Cas	51872.3979	1	II	-	−0.0072	Bír/AP7
VW Cep	52138.3668	3	II	R	0.1434	Bor/AP7
	52138.5030	2	I	R	0.1404	Bor/AP7
DL Cyg	51840.3356	6	I	-	0.0059	Bor/AP7
AK Her	52044.3945	1	II	V	0.0100	Bor/AP7
	52044.3950	1	II	B, R	0.0105	Bor/AP7
	52066.522	1	I	B	0.008	Bor/AP7
	52066.523	1	I	V, R	0.009	Bor/AP7
	52073.479	1	II	R	0.009	Bor/AP7
	52076.4275	1	II	V	0.0073	Bor/AP7
	52076.4279	3	II	B, R	0.0077	Bor/AP7
	52087.3897	3	II	R	0.0099	Bor/AP7
GU Her	52121.385	5	I	-	−0.001	Bor/ST7
UV Leo	51958.5580	2	II	-	0.0219	Bor/AP7
DW UMa	51731.38091	1	I	-	−00042	Bír/AP7
	51842.5785	2	I	-	−0.0006	Bír/AP7
	51916.4822	2	I	-	−0.0010	Bír/AP7
	51925.36220	5	I	-	−0.00040	Bor/AP7
	51958.2848	1	I	-	0.0000	Bor/AP7
	51958.4210	2	I	-	−0.0004	Bor/AP7
	51967.4371	1	I	-	−.0003	Bor/AP7
	52000.35978	5	I	V	0.0002	Bor/AP7
GSC 3822 1056	51731.3672	2	I	-	0.0020	Bír/AP7
	51840.6029	3	II	-	0.0012	Bor/AP7
	51842.6236	8	I	-	0.0076	Bír/AP7
	51925.360	1	I	-	0.003	Bor/AP7
	51958.3628	3	II	-	0.0026	Bor/AP7
	51967.5078	4	I	-	0.0058	Bor/AP7
	52000.3560	5	I	V	0.0056	Bor/AP7

Explanation of the remarks in the table:

Observer(s)/Instrument

Acknowledgements:

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NSV 12223: A NEW W UMa ECLIPSING BINARY

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Strohmeier (1958) discovered the variability of NSV 12223 (= BV 238 = GSC 4456 1244) on photographic plates taken from 1932 to 1939. He mentioned variations going from magnitude 12.0 to 12.5 (photographic) and a probable eclipsing type. The star is situated in Draco at $19^{h}34^{m}31^{s}$; $+74^{o}03'$ (J2000).

Vandenbroere (2000) published the results of period searches made on her 151 first visual estimates of the star in a Note Circulaire of GEOS. She was not yet able to discriminate in favour of the actual period between the peaks of the periodogram and she called upon CCD measurements.

P. Van Cauteren obtained 195 V and 26 B CCD measurements of the star at his private observatory using a 0.40-m telescope. He used an ST7E camera and the MIRA Aperture Photometry software (produced by Axiom Research Inc.). GSC 4456 1751 was used as comparison star and GSC 4457 16 was the check star. The observations were left in the instrumental system. A PDM search on the V measurements showed that the orbital period of NSV 12223 is around 0.350376 d and that the star is an EW-type eclipsing binary with minima slightly different in depth (see Fig. 1). The amplitudes of the light variations in V are of 0.51 mag between the deeper minimum and its preceding maximum, and of 0.43 mag between the two other extrema. The EW type is in perfect agreement with the differential $B-V$ indices which are nearly constant except for a very slight reddening during the two minima.

A. Pigulski analyzed the light curve of NSV 12223 obtained from the CCD observations made by P. Van Cauteren. The V data were phased with a rough value of the period and used with the Wilson-Devinney (WD) code (Wilson & Devinney 1971) to get a synthetic light curve which reproduces well the observations. In the next step, this synthetic light curve was fitted separately to the data carried out on each of the three nights of observations. During the fit, the time of minimum was derived as the only parameter. The results of the fit are shown in Fig. 1. This procedure, taking into account all the points in the light curve, allows to derive the time of minimum light even when there are no observations at minimum at all. So, three times of primary minima could be derived.

To these three times of primary minima, we could add ten instants determined from the visual estimates of J. Vandenbroere (see Table 1). The relative weights for the three CCD times of minimum were calculated according to the inverse square of their r.m.s. errors and were rescaled to be a few times larger than those derived from visual data. A linear regression of all times of minimum gives the following ephemeris (the number in parentheses denotes the r.m.s. error of the last digit):

$$T_{\rm min}\, I = {\rm HJD}\, 2451470.159(2) + 0.350374(2) \times E, \qquad (1)$$

where E is the number of cycles elapsed from the initial epoch.

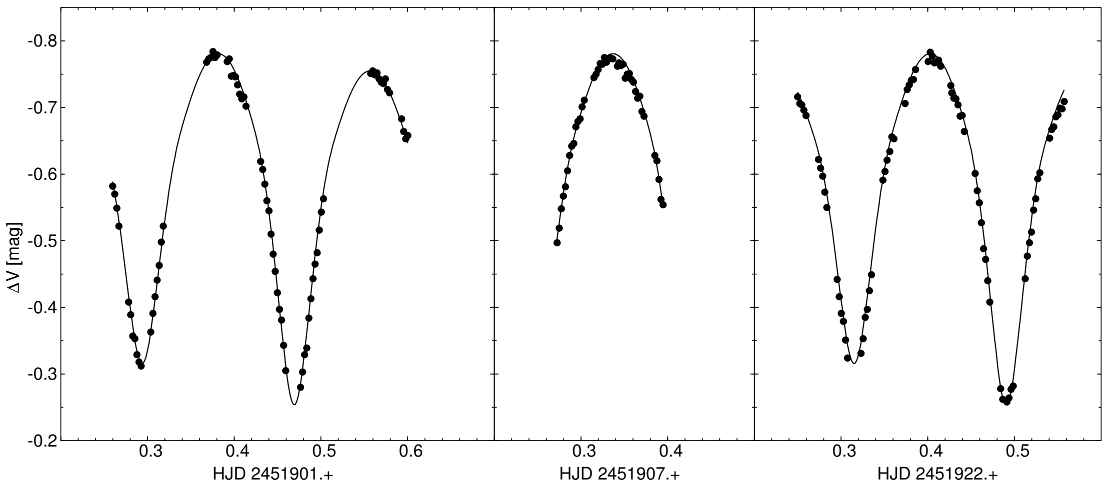

Figure 1. Differential (with respect to GSC 4456 1751) CCD V measurements of NSV 12223 (dots) with synthetic light curve (solid line) fitted to derive the times of minimum for the three nights.

Table 1. Times of minimum light of NSV 12223

Observer	Type of photometry	Time of minimum HJD 2400000.+	Weight	Epoch E	O − C [d]
VBR	visual	51470.332(5)	1	0.5	−0.002
VBR	visual	51757.462(5)	1	820.0	−0.003
VBR	visual	51762.376(5)	1	834.0	+0.006
VBR	visual	51769.381(5)	1	854.0	+0.003
VBR	visual	51779.536(5)	1	883.0	−0.003
VBR	visual	51798.453(5)	1	937.0	−0.006
PVC	CCD	51901.4691(6)	8	1231.0	+0.0003
PVC	CCD	51907.4245(11)	2	1248.0	−0.0007
PVC	CCD	51922.4904(9)	4	1291.0	−0.0008
VBR	visual	52136.397(5)	1	1901.5	+0.003
VBR	visual	52145.500(5)	1	1927.5	−0.004
VBR	visual	52146.379(5)	1	1930.0	−0.001
VBR	visual	52167.401(5)	1	1990.0	−0.001

VBR = J. Vandenbroere, PVC = P. Van Cauteren. HJD is given with an estimated accuracy of the last digit(s).

In order to obtain the parameters of the binary system with the WD code, the CCD data (both in B and V) were first phased with the new value of the orbital period (Eq. (1)). In the case of NSV 12223, we have B and V light curves and we suspect that the system is a contact binary. In Fig. 1, we can see that the maxima are not equal (O'Connell effect).

This means that there is a spot (or spots) on the side surface of one of the stars. Because we have only 26 B CCD measurements, it is rather impossible to adjust accurately the four parameters of a spot. Therefore, it was assumed that the spot resides in star 1 (that one which is eclipsed near phase 0, at primary, deeper eclipse). By trial and error, we found roughly the latitude (90°), longitude (310°) and the angular radius (25°) of the spot. The only spot parameter adjusted was the temperature factor.

Furthermore, gravity darkenings (0.32), bolometric albedos (0.5), and limb darkening coefficients have been taken from tables of Van Hamme (1993). The average temperature of star 1, which is roughly correlated to the orbital period, was assumed to be $T_1 = 5500$ K.

The following parameters of NSV 12223 were next iterated:

- phase shift, ϕ,
- orbital inclination, i,
- average surface temperature of star 2, T_2,
- surface potential, $\Omega = \Omega_1 = \Omega_2$,
- relative monochromatic luminosity for star 1, L_1,
- temperature factor for the spot.

For a contact binary, it is practically the mass ratio $q = M_2/M_1$ which determines the geometry of the system. The best solution is found by checking the changes of the weighted sum of squares of residuals as a function of the assumed mass ratio q (see Fig. 2). We can see that in a wide range of q (between 0.7 and 1.8) all fits give practically the same residuals and therefore are equally good. This means that we cannot accurately determine the mass ratio, and thus say which star is bigger. This is the consequence of the fact that the eclipses are partial.

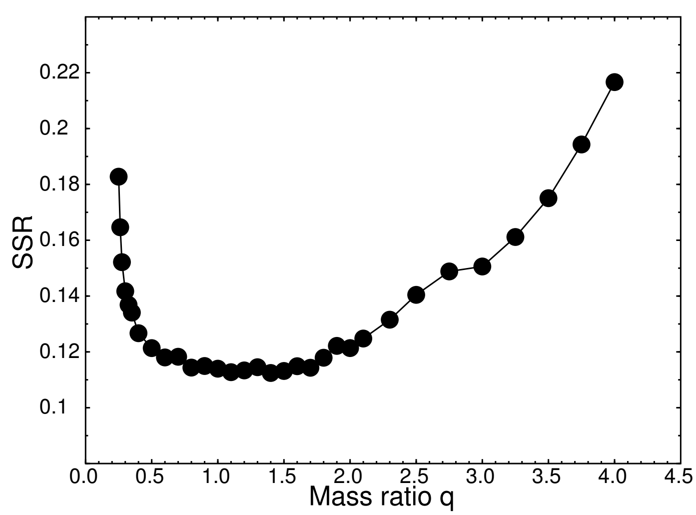

Figure 2. The weighted sum of squares of the residuals (SSR) taken from the best fit, plotted against the assumed value of the mass ratio, q.

Nevertheless, it appears that some parameters which were iterated do not change considerably in the best solutions for $0.7 < q < 1.8$. First of all, the inclination angle, i, equals to $72\overset{\circ}{.}0 \pm 0\overset{\circ}{.}5$, and the average surface temperature of star 2, T_2, is lower by about 110 ± 10 K in comparison with T_1. Finally, the overfill factor equals to about 5–7%, depending on q. This is quite typical for W UMa systems. In Fig. 3 we show one of the best solutions, that with $q = 1.4$. The standard deviation of the residuals from the fit is 0.0097 mag for B and 0.0082 mag for V-filter observations.

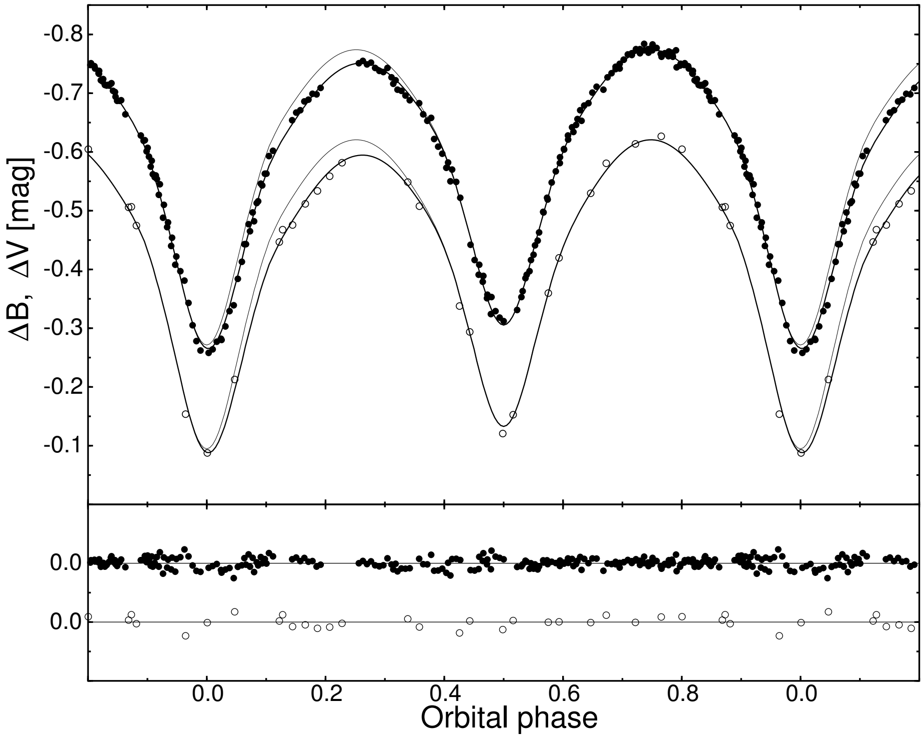

Figure 3. The differential light curve of NSV 12223 in B (circles) and V (dots) filter compared to the best fit with $q = 1.4$ (continuous line). The light curves shown with thin lines are those if there were no spot. Lower panel shows the residuals from the fit (the ordinate is in scale).

Concluding, NSV 12223 is a contact binary of the W UMa type with orbital period given by Eq. (1). The eclipses are partial. The inclination of the system is $72^{\circ}\!.0 \pm 0^{\circ}\!.5$. Mass ratio is in the range between 0.7 and 1.8. There is a spot at the surface of one of the stars resulting in a small O'Connell effect. Moreover, star 2 is cooler than star 1 by about 110 K.

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PERIOD CHANGE OF ES Del

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A few stars among Mira-type variables are known to show period changes. The period changes of R Aql, R Hya and W Dra are interpreted to be a result of helium shell flash (Wood and Zarro 1981).

ES Del was first proposed as a Mira-type variable with a period of $373\overset{d}{.}9$ (Huth 1956; Huth et al. 1957). However, disagreement was pointed out (Kholopov 1986) between this period and the maximum dates observed later (Halle 1974). Furthermore, a $509\overset{d}{.}6$ period was recently proposed (Watanabe 2000). I analyzed the available data in order to verify the possible period change.

Four data sources were used for analysis: (1) four maximum times reported in Huth et al. (1957), (2) two maximum times reported in Halle (1974), (3) five maximum times reported in Watanabe (2000), and (4) five maximum times estimated from the AFOEV database. In addition, five intervals around maximum times were estimated from the AFOEV database, whose exact times were not determined due to the lack of observations or due to the solar conjunction, were used to verify the cycle count.

At first, $O-C_1$ values were calculated against the $373\overset{d}{.}9$ period: $Maximum_1 =$ JD $2427954 + 373.9 \times E_1$ (Huth et al. 1957), which are listed in Table 1. The $O-C_1$ diagram is shown in Figure 1. For some maxima, whose cycle counts are ambiguous because of the lack of contiguous detection of maxima, the calculated cycle numbers nearest to the observed maxima were assumed. Figure 1 shows that $O-C_1$ values are approximately constant between 1935 and 1949 ($E_1 = 0$ to 14), confirming the $373\overset{d}{.}9$ period reported by Huth (1957). However, after 1957 ($E_1 = 21$), $O-C_1$ values significantly increased, implying that the period became longer than $373\overset{d}{.}9$.

$O-C_2$ values were then calculated against the $509\overset{d}{.}6$ period: $Maximum_2 =$ JD $2450290 + 509.6 \times E_2$ (Watanabe 2000), which are listed also in Table 1. The $O-C_2$ diagram is shown in Figure 2. After 1982 ($E_2 = -10$), $O-C_2$ values are approximately constant, supporting the recent identification of the $509\overset{d}{.}6$ period.

None of these periods can properly represet the maxima between 1957 and 1982. Between 1949 and 1965, a period of 472^d or 404^d better represent observations.

A period increase of 136^d (from $373\overset{d}{.}9$ to $509\overset{d}{.}6$) was observed during 33 years (from 1949 to 1982). If the period increased at a constant rate: $P_E = P_0 + A \times E$, than the rate of increase A should be $0\overset{d}{.}24$. This case, the expected period increase is 37^d in 17 years. However, the actual period increase during the recent 17 years (between 1982 and 1999)

Table 1. Observed maximum dates and $O-C$ values

Data Source	Maximum date UT	JD	Some probable cycle numbers E and $O-C$ values: $E_1/O-C_1$ [a]	$E_2/O-C_2$ [b]
VSS	1935 May 4	2427927	0/*−27*	−51/*3627* ... −46/*1079*
VSS	1940 Aug. 8	2429850	5/*27*	−46/*3002* ... −41/*454*
VSS	1948 Sep. 2	2432797	13/*−18*	−38/*1872* ... −33/*676*
VSS	1949 Oct.15	2433205	14/*16*	−37/*1770* ... −32/*778*
MVS	1957 Jul.14	2436034	21/*228* , 22/*−146*	−31/*1542* , −29/*522*
MVS	1965 Apr.10	2438861	28/*438* , 29/*64*	−24/*801* , −22/*−218*
AFOEV	1982 Aug. 3	2445185	40/*2275* ... 46/*31*	−10/*−10*
AFOEV	1984 Jan.	—	41/ — ... 47/ —	−9/ —
AFOEV	1985 May	—	42/ — ... 48/ —	−8/ —
AFOEV	1986 Oct.12	2446716	43/*2684* ... 49/*440*	−7/*−7*
AFOEV	1988 Feb.	—	44/ — ... 50/ —	−6/ —
AFOEV	1989 Aug.10	2447749	45/*2969* ... 51/*726*	−5/*7*
VSOLJ	1990 Dec.26	2448252	46/*3099* ... 52/*855*	−4/*0*
AFOEV	1991 Jan.	—	46/ — ... 52/ —	−4/ —
AFOEV	1992 Apr.	—	47/ — ... 53/ —	−3/ —
AFOEV	1993 Nov. 2	2449294	48/*3392* ... 54/*1149*	−2/*23*
AFOEV	1995 Feb.	—	49/ — ... 55/ —	−1/ —
VSOLJ	1995 Mar. 1	2449778	49/*3503* ... 55/*1260*	−1/*−2*
VSOLJ	1996 Jul.27	2450292	50/*3643* ... 56/*1400*	0/*2*
VSOLJ	1997 Dec.15	2450798	51/*3775* ... 57/*1532*	1/*−2*
VSOLJ	1999 May 11	2451310	52/*3913* ... 58/*1670*	2/*1*

[a] $Maximum_1 = 2427954 + 373.9 \times E_1$ (Huth et al. 1957)
[b] $Maximum_2 = 2450290 + 509.6 \times E_2$ (Watanabe 2000)

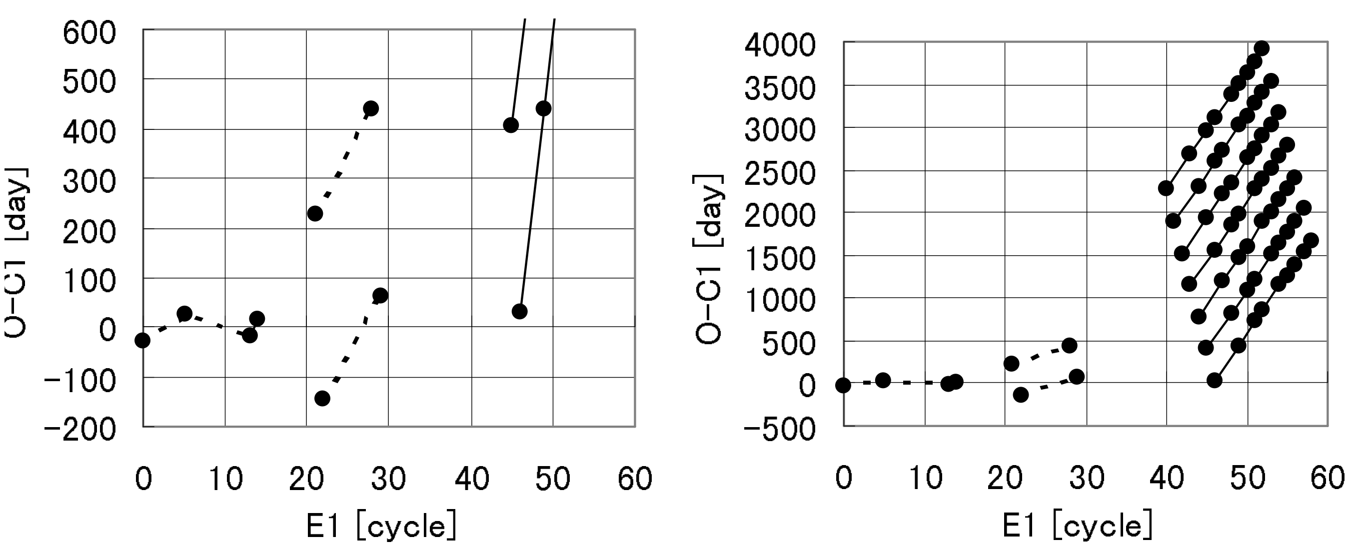

Figure 1. $O-C_1$ diagrams using the ephemeris: $Maximum_1 = 2427954 + 373.9 \times E_1$. $O-C_1$s for the maxima with successively identified cycle counts are connected by solid lines. $O-C_1$s of other maxima are connected by dashed lines.

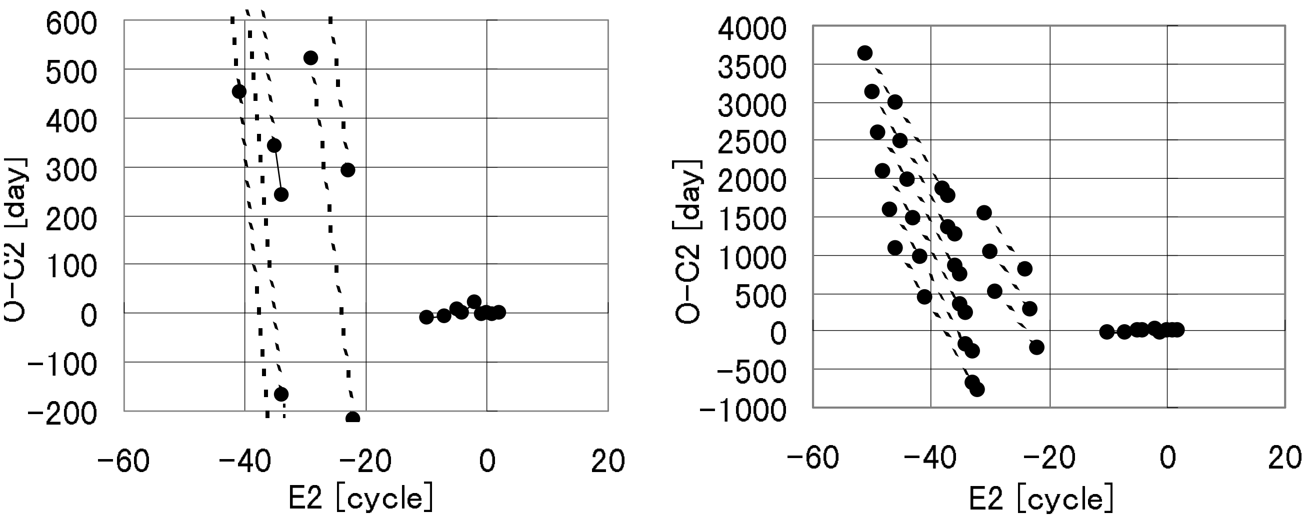

Figure 2. $O - C_2$ diagrams using the ephemeris: $Maximum_2 = 2450290 + 509.6 \times E_2$. The lines and dashed lines are the same as described in Figure 1.

is less than 11^{d} (Table 1). This result indicates that the period change of ES Del is not linear.

The period of ES Del is: $P = 373\overset{\mathrm{d}}{.}9$ between 1935−1949, $P = 404^{\mathrm{d}}$ or 472^{d} between 1949−1965, $P = 509\overset{\mathrm{d}}{.}6$ between 1982−1999. The period change is not linear. ES Del may be one of the few Mira-type stars experiencing a shell flash stage, as R Aql and R Hya. More observations, as well as archival plate search are needed to more accurately determine the nature of this period change, and to understand the evolutionary status of ES Del.

I am grateful to the staff of AFOEV for making their data available for me. I wish to thank Makoto Watanabe for his valuable suggestion, and I wish to thank especially Dr. Taichi Kato (Kyoto University) for his helpful discussion.

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PERIODS OF ELEVEN K5-M0 PULSATING RED GIANTS

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About 10 per cent of the naked-eye stars are pulsating red giants (PRGs), with amplitudes ranging from 0.01 to 10 magnitudes. According to Wood (2000), "red giant stars are probably the least understood of all variable stars". The first PRG — Mira — was discovered over 400 years ago. Small-amplitude PRGs, with amplitudes of 0.1 to 1 magnitude, and with early M spectral type, were surveyed by Stebbins & Huffer (1930). In the 1990s, several studies (Eyer & Grenon 1998, Grenon 1993, Jorissen et al. 1997) showed that K5-M0 giants were variable with amplitudes of less than 0.1 magnitude, and these were most likely PRGs. In particular, Henry et al. (2000) studied a large sample of variable K-M0 giants, estimated their variability time scales from the light curves, and presented a strong argument for pulsation as the cause of the variability of the K5-M0 giants. This paper presents the first detailed period analysis of a sample of these ultra-small-amplitude PRGs.

It is still not clear whether the Mira stars are pulsating in the fundamental mode, or in the first overtone. The small-amplitude PRGs appear to be pulsating in higher modes (Percy & Parkes 1998), in agreement with theoretical predications (Xiong et al. 1998). Since the pulsation modes of the ultra-small-amplitude PRGs is therefore of interest, it is important to determine their periods in as many ways as possible. This is because methods such as Fourier analysis have weaknesses (such as the possible occurrence of alias periods if there are periodic gaps in the data) which are not present in other methods such as our form of autocorrelation analysis. Also — many small-amplitude PRGs have a secondary period, an order of magnitude longer than the primary period, so it would be of interest to look for such long periods in ultra-small-amplitude PRGs. Koen & Laney (2000) have recently pointed out that there are about 30 PRGs in the *Hipparcos* Catalogue with periods less than 10 days, whose radii and masses imply that they are pulsating in very high overtones. We believe that these periods are spurious, and due to the aliasing properties of *Hipparcos* photometry (Percy & Hosick, submitted), but this points out the need to do careful period analysis using as many independent techniques as possible.

In the past (Percy et al. 1996), we found that light curves, Fourier analysis, and autocorrelation analysis were useful and complementary tools for studying small-amplitude PRGs. In our autocorrelation algorithm, we calculate the absolute value of Δmag, and

Table 1: Periods of Eleven Ultra-Small-Amplitude Pulsating Red Giants

HD	V mag	Spectral Type	V range	TS	period(s) - days
3346	5.16	M0 III	0.065	11	**11.5**, 15, 22:
84345	8.21	M0 III	0.056	15	**12.4**, 21.5
112975	7.51	M0 III	0.056	7	**6.9**
123232	7.73	M0 III	0.100	12	19.4, 35.7
145895	7.60	M0 III	0.043	10	**9.6**, 6-7:, 70:
155038	7.67	K5 III	0.037	5	**4.8**, 27:
175589	7.30	K5 III	0.041	8	**6.9**, 20:, 40:
196643	7.10	K5 III	0.044	7	7, 15
201298	6.18	M0 III	0.041	12	13, 40:
208530	7.85	M0 III	0.041	15:	**10.4**, 5:, 50:
215427	7.08	K5 III	0.054	30	16, 27:

Δtime for every pair of measurements, and plot the first (averaged in bins) against the second, over an appropriate range of Δtime. Minima occur at multiples of the period or characteristic time scale. Since our algorithm differs from conventional autocorrelation, we shall hereafter use the term *self-correlation* — a term suggested by I. Cummings (1999). It is similar to the "variogram" method described by Eyer & Genton (1999) (Eyer 2001, private communication). Note that our autocorrelation diagram is not a phase diagram, or a power spectrum. We have used this combination of three techniques to analyze new and existing data on 11 stars in Henry et al.'s sample (these authors estimated the periods of these stars by visual inspection of the light curves only). The data were obtained with a robotic telescope, as described by Henry et al., between JD 2450700 and 2451000 (but with a seasonal gap for most stars), except for HD 3346, for which there were four seasons of data, and HD 215427, for which there were three. The number of data points per season ranges from 40 to 180. Data were obtained through both a blue and a yellow filter; both sets of data gave the same period results.

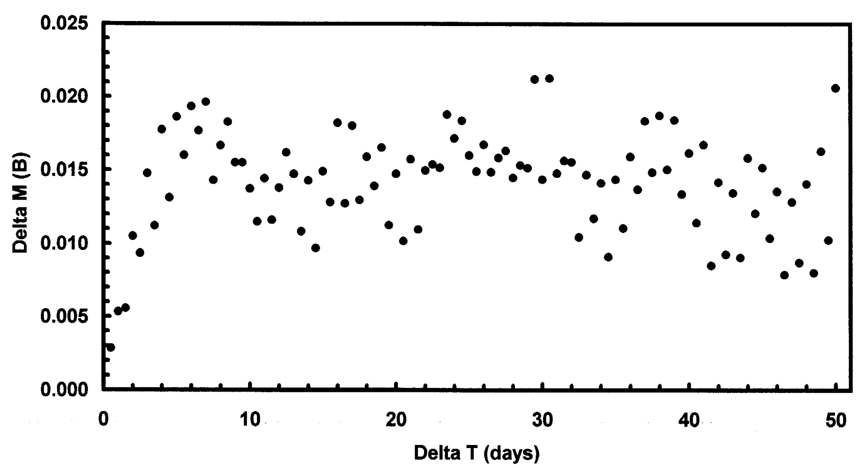

Figure 1. The selfcorrelation diagram for HD 3346. The first maximum (at 5.5 to 7.5 days), and the first minimum (from 11 to 15 days), are consistent with the periods of 11 and 15 days which appear in the power spectrum.

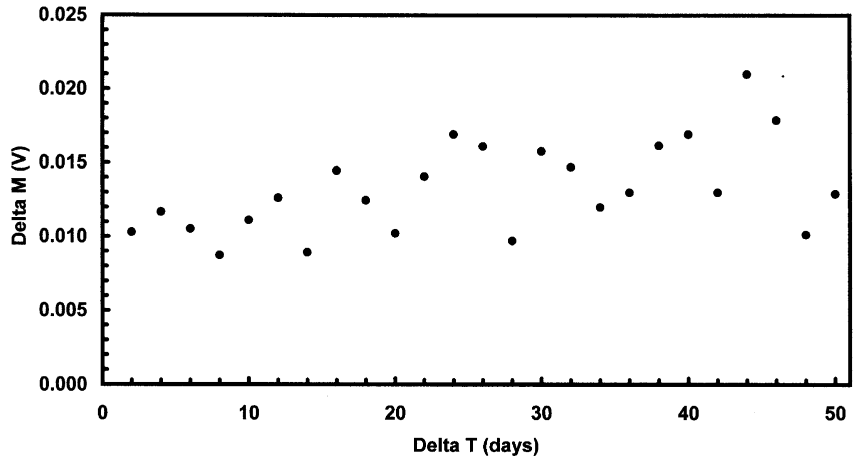

Figure 2. The selfcorrelation diagram for HD 112975. Note the minima at multiples of 6.9 days.

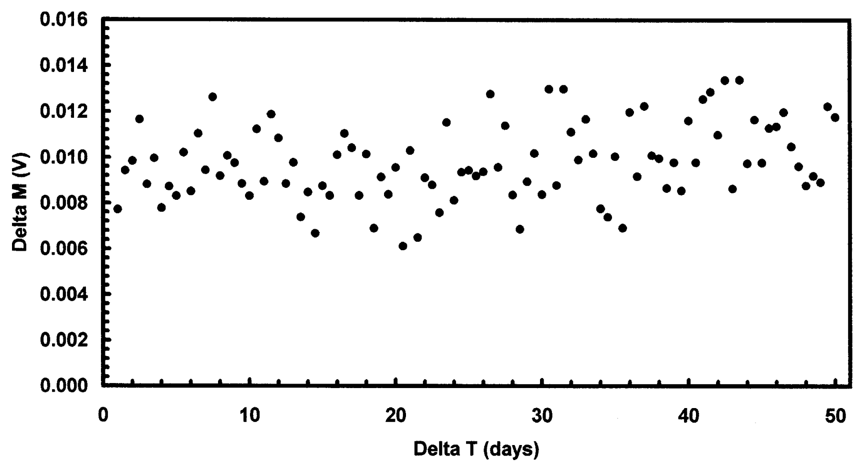

Figure 3. The selfcorrelation diagram for HD 155038. The alternating maxima and minima are consistent with a period of 4.5 days.

Table 1 lists the pertinent information about the stars, and the results. TS is the variability time scale in days found by Henry et al. (2000). The second-last column lists the period(s) determined in this paper. Values in bold face are most secure; those marked with a colon (:) are most uncertain. The following notes apply to individual stars: **HD 3346**: power spectra show an 11.5-day period in each of four seasons, 15-day period in three seasons, and 22-day period in two seasons; selfcorrelation diagram (hereafter *acf*: Figure 1) is consistent with periods of 11.5 and 15 days. **HD 84345**: power spectrum suggests periods of 21.5, 12.4, and 30.5 days, in order of decreasing power; acf is consistent with first two. **HD 112975**: 6.9-day period is conspicuous in the power spectrum and acf (Figure 2). **HD 123232**: visual inspection of the light curve (hereafter LC) suggests about 18-day cycles; power spectrum and acf are consistent with 19.4- and 35.7-day periods. **HD 145895**: 9.6-day period is conspicuous in the power spectrum and acf; power spectrum and LC also suggest a period of 70±10 days. **HD 155038**: a period of

4.8 days is present in the power spectrum and acf (Figure 3). **HD 175589**: periods of 6.9 and 20 days are present in the power spectrum and acf; power spectrum and LC also suggest a time scale of 40 days. **HD 196643**: both power spectrum and acf give a weak signal at 7 and possibly 15 days. **HD 201298**: power spectrum and acf are consistent with a period of 13 days; possibly longer-term variations. **HD 208530**: 10.4-day period is conspicuous in the power spectrum and acf; possible variations on a time scale of 40-50 days. **HD 215427**: power spectrum and acf are consistent with a period of 16 days in each season; possible 27-day period.

Preliminary analysis of another season of data (2000-2001) shows good to excellent agreement, for the stars with well-determined periods (Percy & Nyssa, to be published). Several more seasons of data may be necessary to determine, completely, the periods in these stars (e.g. Percy et al. 1996).

The data are not well suited for looking for long-term variability, but several stars — notably HD 84345, HD 112975, HD 145895, HD 208530 and HD 215427 — show some evidence for variability on time scales of 100 days or more, with amplitudes of a few hundredths of a magnitude.

The results indicate that ultra-small-amplitude PRGs behave as small-amplitude PRGs do: they have one or two periods which are consistent with radial pulsation periods; they are semi-regular at best; some have longer-term variations with about the same amplitude as the shorter-term variations. Fourier analysis and auto/selfcorrelation analysis are both useful in understanding the behaviour of these stars. We are now in the process of determining the probable pulsation modes in these stars, by determining their pulsation constants (Q-values). Very preliminary results indicate that the ultra-small-amplitude PRGs, like the small-amplitude PRGs, pulsate in the fundamental, first, second, or third overtone.

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THE RRab STAR UX Tri: DISCOVERY OF A BLAZHKO EFFECT WITH CHANGING PERIOD

BAV Mitteilungen Nr. 146

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The variability of UX Trianguli was discovered in 1934 by Morgenroth (1935) and described having a "long period". In the NSV catalogue (Kukarkin et al., 1982/1988) the star is listed as NSV 616 being of semiregular type (SR). Later the star has been analyzed from Sonneberg sky patrol plates and was classified as RRab type with a period of 0.466917 days by Meinunger (1986). Regarding the light curve in this paper, Meinunger already remarked a fairly large scatter of the magnitude estimations, which he did not completely attribute to random errors, but finally he was not able to reveal any systematic reason. In 1989 the star was named UX Tri in the 69th namelist (Kholopov et al., 1989). We want to confirm that UX Tri = CSV 164 = NSV 616 is identical with GSC 2294.506. The identification is in good agreement with the finding charts given by Morgenroth (1935) and Tsessevich et al. (1971).

Morgenroth and the NSV report reasonable photographic magnitudes of $13\overset{m}{.}5$ - $14\overset{m}{.}5$ for the star, whereas, the photographic magnitudes given by Meinunger ($10\overset{m}{.}5$ - $11\overset{m}{.}5$) are much too bright. This is due to the magnitudes of the reference stars used in the analysis of Meinunger. He used the stars **a** = GSC 2294.1576 (USNO A2.0: B = $12\overset{m}{.}9$; R = $12\overset{m}{.}0$) assuming $10\overset{m}{.}6$ and **b** = GSC 2294.916 (USNO A2.0: B = $13\overset{m}{.}9$; R = $13\overset{m}{.}0$) with $11\overset{m}{.}4$ which resulted in an overestimation of the brightness of UX Tri.

From 1997 to 2001 we observed UX Tri in 42 nights obtaining CCD photometric data and 36 new maximum timings.

As principal comparison star we used GSC 2294.1202 (GSC: $V = 11\overset{m}{.}7$; USNO A2.0: B = $13\overset{m}{.}0$; R = $11\overset{m}{.}6$). Our differential magnitudes refer to this star and are derived from instrumental magnitudes. We used Pogson's method and/or the determination of a polynomial maximum for the maximum timings. The scatter due to different timing methods is contained in the errors given in Table 1 which lists our maximum timings.

The maximum timings show considerable scatter in $(O-C)$ when linear elements are used (see Fig. 1) and the light curve is variable (see Fig. 2). The classification of the variable as RRab star is in agreement with the light curves. Analyzing the scatter of the maximum timings and the brightness at maximum we discovered a pronounced Blazhko effect which is described and analyzed in this paper.

Table 1: Observed times of maxima for UX Trianguli $(O-C)_1$, residuals computed according to the linear ephemeris from formula (1) and $(O-C)_c$ residuals corrected for Blazhko effect with formula (3).

Max					Max				
JD hel. – 2400000	±* [d]	$(O-C)_1$ [d]	$(O-C)_c$ [d]	rem.	JD hel. – 2400000	±* [d]	$(O-C)_1$ [d]	$(O-C)_c$ [d]	rem.
50481.2933	.0083	0.0207	0.0082	A $\mathbf{a}_x$	51927.3355	.0049	0.0061	0.0009	A **a**
51471.6276	.0069	0.0139	−0.0032	A **a**	51934.3279	.0069	−0.0053	0.0026	A **a**
51494.5030	.0017	0.0101	0.0127	A **a**	51948.3021	.0083	−0.0388	−0.0048	A **a** :
51522.5401	.0035	0.0319	0.0053	A **a**	51975.4271	.0083	0.0047	0.0078	A **a** :
51595.3160	.0100	−0.0320	−0.0044	A $\mathbf{a}_x$	51983.3466	.0042	−0.0134	0.0044	A **a**
51810.5809	.0028	−0.0181	0.0035	A **a**	52144.4542	.0024	0.0062	−0.0016	H $\mathbf{d}_V$
51817.5708	.0069	−0.0320	0.0026	A **a**	52144.4546	.0024	0.0066	−0.0012	H $\mathbf{d}_R$
51817.5718	.0045	−0.0310	0.0036	H **b**	52144.4559	.0022	0.0079	0.0001	H **c**
51840.4846	.0100	0.0026	−0.0015	A $\mathbf{a}_x$	52151.4427	.0020	−0.0092	−0.0039	H **c**
51853.5399	.0035	−0.0159	0.0044	A **a**	52191.6007	.0017	−0.0064	−0.0077	A **a**
51854.4687	.0021	−0.0209	0.0010	A **a**	52198.5891	.0035	−0.0219	−0.0102	A **a**
51874.5906	.0083	0.0234	0.0013	A $\mathbf{a}_x$	52198.5911	.0050	−0.0199	−0.0081	H **e**
51884.3709	.0020	−0.0017	−0.0055	H **b**	52199.5317	.0035	−0.0131	0.0004	H **e**
51904.4160	.0056	−0.0342	−0.0006	A **a**	52213.5110	.0069	−0.0415	−0.0019	A **a**
51912.4174	.0100	0.0295	−0.0035	A $\mathbf{a}_x$	52228.4968	.0028	0.0028	−0.0112	A **a**
51919.4125	.0069	0.0208	0.0008	A **a** :	52230.3650	.0100	0.0033	−0.0072	H **c**
51921.2761	.0028	0.0167	0.0002	A **a**	52233.6315	.0025	0.0014	−0.0030	A **a**
51926.4039	.0028	0.0083	0.0014	A **a**	52233.6325	.0100	0.0024	−0.0020	H **c**

* estimated errors of the maximum timings
remarks (rem.):
Observers: A = Achterberg; H = Husar
Observations with V or R band filters are marked with suffix „V" or „R" respectively; those marked with suffix „$_x$" are extrapolated maximum timings; „ : " denotes uncertain timing
Instrumentation:
a 0.2 m Schmidt-Cassegrain (f=1100 mm) with CCD-camera SBIG ST-6 (chip: TI TC241); unfiltered
b 0.4 m Schmidt-Cassegrain (f=1450 mm) with CCD-camera Apogee AP-7 (chip: SITe 502); unfiltered
c 0.4 m Schmidt-Cassegrain (f=2750 mm) with CCD-camera SBIG ST-8E (chip: KAF1602E); IR-cutoff filter
d 0.4 m Schmidt-Cassegrain (f=2750 mm) with CCD-camera SBIG ST-8E (chip: KAF1602E); V/R-filter (Bessel type)
e 0.2 m Schmidt-Cassegrain (f=1185 mm) with CCD-camera SBIG ST-8E (chip: KAF1602E); unfiltered

First of all a new linear ephemeris formula of the times of maximum light of UX Tri was derived using the photographic maxima from Meinunger, including two CCD observations made by Birkner (1998a, 1998b) and all our CCD observations from Table 1:

$$\begin{array}{c} \text{Max} = \text{HJD } 2450753.488 + 0\overset{\text{d}}{.}4669218 \times E. \\ \qquad\qquad\qquad\pm .005 \quad \pm .0000003 \end{array} \tag{1}$$

The given elements are based on the assumption that the maximum timings should be symmetrically distributed around zero. $(O-C)$-values calculated with formula (1) are termed $(O-C)_1$ and are shown in Fig. 1.

The rather definite spread of the $(O-C)_1$-values nearly in the whole time of observations points to the Blazhko effect, a phenomenon which is known from numerous RR Lyrae stars showing periodic light curve variations. Besides the phase position of the maximum also other characteristics of the light curve such as brightness at maximum, brightness amplitude and the rise time *M-m* (time difference between maximum and the preceding minimum) show periodic variations. Nevertheless, this periodicity is in most cases not completely exact. According to Smith (1995) a pronounced characteristic of the Blazhko effect is its irregularity.

The periodic variation in the light curve can be revealed best in a "Blazhko diagram", as we call the plot of the measurements of the mentioned characteristics against the

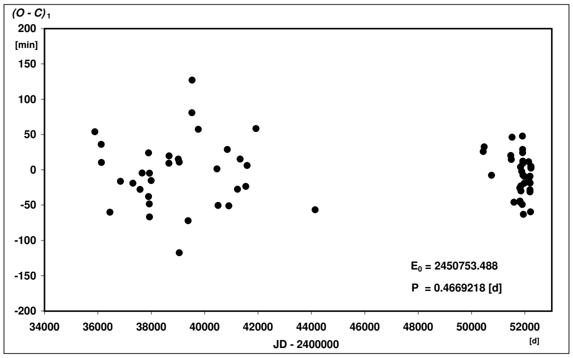

Figure 1. diagram of $(O-C)_1$-values for the available times of maximum light based on new elements (1).

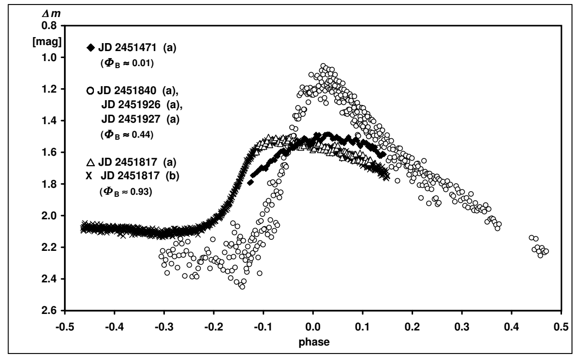

Figure 2. observed phased light curves with different amplitudes based on elements (1) at three phases of the Blazhko cycle. (**a**)/(**b**) refers to the instrumentation.

Blazhko phase Φ_B:

$$\Phi_B = \mathrm{Frac}((t - E_{B0})/P_B), \tag{2}$$

where P_B is the Blazhko period, E_{B0} an arbitrary initial epoch, t the time of a measurement and Frac(x) the digits behind the decimal point of x .

The value of the Blazhko period was determined independently with periodograms from a self written computer program and the program 'Period98' by Sperl. Including all available measurements of $(O-C)_1$-values *no single* Blazhko period could be found. The reason for this may be irregularities of the Blazhko effect (e.g. changes in the period P_B, phase jumps or decreasing amplitude of the variations) and errors of the measurements, especially of the photographic observations. However in two epochs of time a Blazhko period could be discovered. In the range from JD 2439023 to JD 2441931 the most probable value found for the Blazhko period is P_B = 40.0 d ± 0.1 d. From JD 2450446 till now the Blazhko period has been determined to be P_B = 43.7 d ± 0.15 d. The first value of P_B results from the $(O-C)_1$-values only and the second value from the $(O-C)_1$-values *and* from the brightness values at maximum. Within the small range of given errors both programs yielded the same values of P_B. These results show that the period of the Blazhko effect of UX Tri is most probably *not constant*.

For our CCD measurements Fig. 3 shows the Blazhko diagram for the $(O-C)_1$-values and Fig. 4 for the brightness of maximum at the found period value P_B = 43.7 d and for the value E_{B0} = 2451471. In the phase range $\Phi_B \approx 0.02-1.00$ the course of the $(O-C)_1$-values in Fig. 3 can be well approximated by a dropping straight line. In the range $\Phi_B \approx 0.00-0.02$ a very steep rise occurs. Because in this range there are not enough points of measurements to determine an average $(O-C)_1$-course any approximation is only tentative.

The Blazhko diagram for the brightness of maximum (Fig. 4) reveals a relatively large spread of the points around the drawn average curve. One reason for this could be systematic errors in the measured brightness values caused by different equipment used by the observers. It seems, however, that especially in the range $\Phi_B \approx 0.35-0.60$ also irregularities of the Blazhko effect contribute to this spread.

With the help of the average curves in Fig. 3 and Fig. 4 it is possible to obtain more accurate time and brightness values of the maximum making predictions for the near future. For that purpose it is necessary to calculate first an approximate value $\mathrm{Max}_{(\mathrm{linear})}$ for the time of maximum with the formula (1) and in a second step the corresponding Blazhko

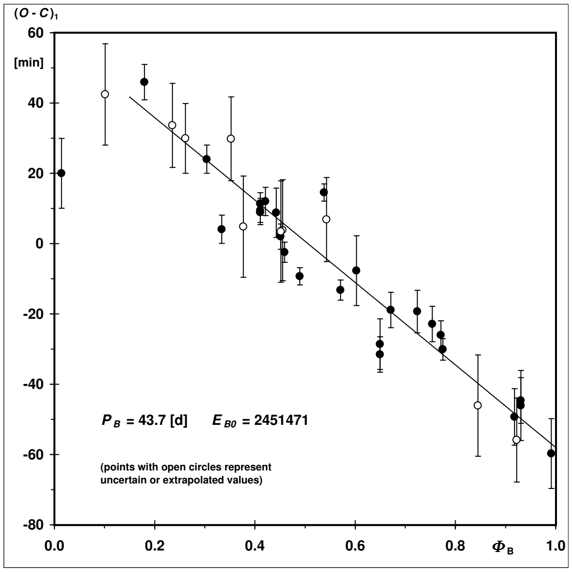

Figure 3. Blazhko diagram for the $(O-C)_1$ values of our CCD measurements. The drawn mean curve yields the correction values ΔT_B in dependence of the Blazhko phase Φ_B

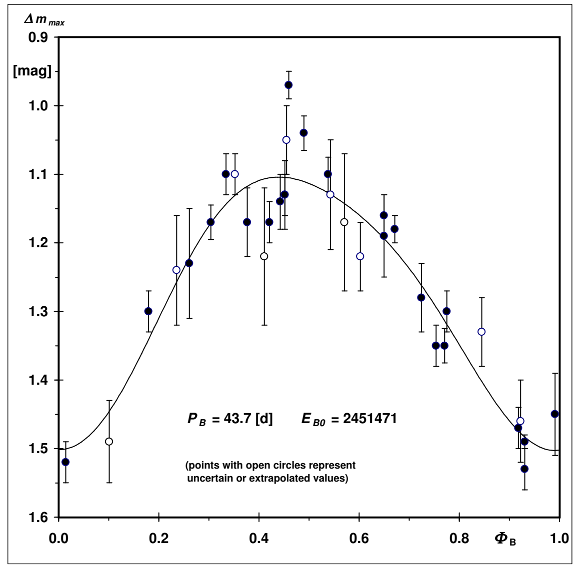

Figure 4. Blazhko diagram for the brightness values at maximum of our CCD measurements. The drawn curve yields mean values for the brightness at maximum in dependence of the Blazhko phase Φ_B

phase Φ_B with the formula (2). For this Blazhko phase Φ_B the curve in Fig. 3 yields a value ΔT_B to correct the time of maximum

$$\mathrm{Max}_{(\mathrm{corrected})} = \mathrm{Max}_{(\mathrm{linear})} + \Delta T_B, \qquad (3)$$

and the curve in Fig. 4 yields direct the brightness of the maximum. In Table 1 the differences $(O-C)_c$ between the observed times and the calculated values with formula (3) are given. The scatter of these values however is larger than the error of those maximum timings which could be obtained with sufficiently small errors. This indicates that the Blazhko effect of UX Tri may need more than one period to be completely described.

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PHOTOMETRIC VARIABILITY OF THE STARS USNO 0900-17903132, HD191674 AND HD 191616

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As part of a continuing search for photometric variations in stars which are known X-ray sources, we observed HD 191616 (=GSC 0503-0700). This star, also known as RXJ201043+045449, was discovered to be a source of X-rays by the ROSAT satellite (Voges et al. 1999). The Tycho catalog (ESA 1997) reported $V_T=9^{\rm m}\!.497$ and $B_T=10^{\rm m}\!.724$ for HD 191616 and $V_T=9^{\rm m}\!.000$ and $B_T=10^{\rm m}\!.238$ for one of the field stars, HD 191674 (=GSC 0503-1409), both consistent with a spectral type of approximately K0. The reported parallaxes favor dwarf luminosity class but do not exclude giant status.

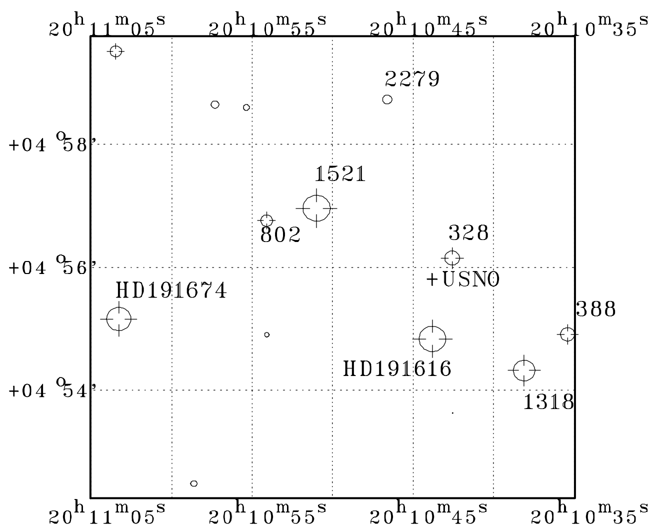

Figure 1. Finder chart labeled with the GSC identification numbers from region 0503.

The field of stars observed with the automated 0.5m telescope of the Climenhaga Observatory at the University of Victoria is shown in Figure 1. The data were reduced in a fashion similar to that described in Robb and Greimel (1999). Table 1 lists the stars' identification numbers, coordinates (J2000) and magnitudes from the Hubble Space

Table 1: Stars observed in the field of HD 191616=GSC 0503-0700 and HD 191674=GSC 0503-1409

Star Id	R.A. J2000	Dec. J2000	GSC Mag.	ΔR_c Mag.	Std Dev Between	Std Dev Within	$(R-I)$
HD 191616	$20^h10^m44^s$	$4°54'50''$	8.8	0.490	.022	.004	0.4
GSC 0503-1521	$20^h10^m51^s$	$4°56'57''$	8.6	-	-	-	0.4
HD 191674	$20^h11^m03^s$	$4°55'10''$	9.3	$-.222$	.025	.003	0.4
GSC 0503-1318	$20^h10^m38^s$	$4°54'19''$	10.0	1.447	.003	.003	0.4
GSC 0503-388	$20^h10^m35^s$	$4°54'55''$	11.9	3.428	.004	.007	0.2
GSC 0503-328	$20^h10^m43^s$	$4°56'09''$	11.7	3.060	.004	.009	0.4
USNO 900-17903132	$20^h10^m43^s$	$4°55'51''$	13.9	4.787	.157	.036	2.3
GSC 0503-802	$20^h10^m54^s$	$4°56'45''$	12.4	3.474	.002	.007	0.3
GSC 0503-2279	$20^h10^m47^s$	$4°58'44''$	13.1	4.579	.011	.019	0.2

Telescope Guide Star Catalog (GSC) (Jenkner et al., 1990). Observations were made using filters closely matching the Cousins R and I bands (Cousins 1981). The thirty-two Julian Dates of observation (-2450000) are 2121, 2122, 2129-2138, 2150, 2151, 2157-2166, 2168, 2169, 2175, 2176, 2179, 2180, 2182 and 2184.

Our differential ΔR_c magnitudes are calculated in the sense of the star minus GSC 0503-1521. Brightness variations during a night were measured by the standard deviation of the differential magnitudes and are listed for the most photometric night in the last column as "Std Dev Within". For each star the mean of the nightly means is shown as ΔR_c in Table 1. The standard deviation of the nightly means is a measure of the night to night variations and is called "Std Dev Between" in Table 1.

The "Std Dev Between" for stars [GSC 0503-1318 - GSC 0503-1521] is 0.003 magnitudes. This excellent photometry shows that night to night variations in either of these stars must be less than a few millimagnitudes. We observed no significant variations in these stars in plots of the individual nights' data and a "Std Dev Within" one night of 0.003 sets an upper limit on variations of an hourly timescale.

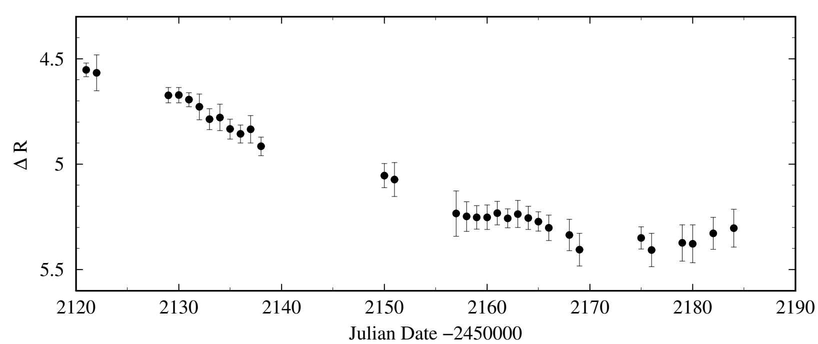

Figure 2. ΔR_c filtered light curve of USNO 0900-17903132 for summer 2001

In Figure 2 we have plotted the nightly mean and standard deviation of the ΔR_c brightness of the star USNO 0900-17903132. Obviously it is a variable star with a timescale of at least a hundred days and from our $(R-I)_c$ we estimate a spectral type of late M. We expect this star to be a long period variable and urge observers to monitor its brightness and discover its amplitude and periodicity, if any.

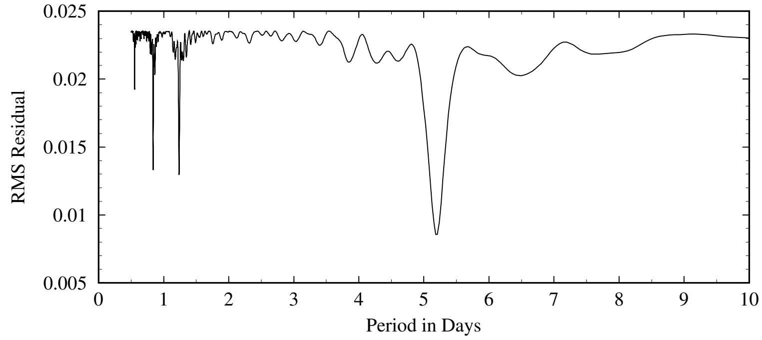

Figure 3. Periodogram for HD 191674 in 2001

The star HD 191674 had obvious night to night variations. The root-mean-square (RMS) deviation of a data point from a sine curve as a function of period is shown in Figure 3. From this periodogram we find the ephemeris to be:

$$\text{HJD of Maximum Brightness} = 2452118\overset{\text{d}}{.}3(9) + 5\overset{\text{d}}{.}21(15) \times \text{E}.$$

where the uncertainties in the final digit are given in brackets and the RMS error of the fit is less than 0.01 magnitudes. The 3685 differential ΔR_c magnitudes phased at this period are plotted in Figure 4 with different symbols for each cycle.

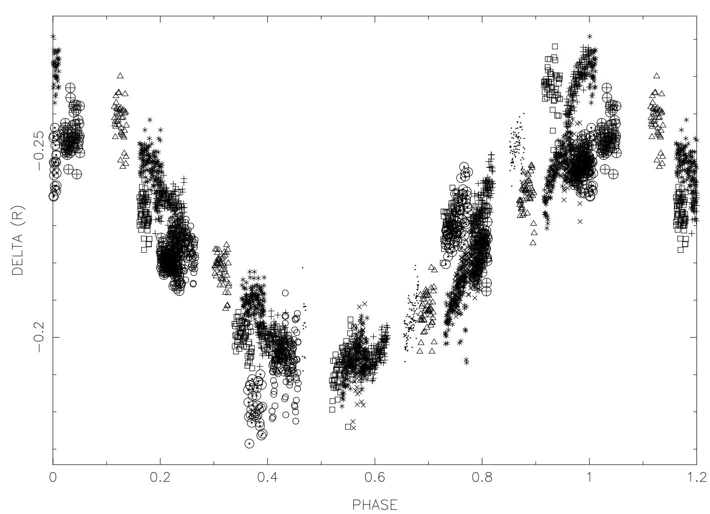

Figure 4. R_c filtered light curve of HD 191674

There are significant differences from cycle to cycle but doubling the period did not improve the fit. The $(R-I)_c$ is consistent with the Tycho B_T and V_T measurements indicating that the star is approximately K0 spectral type. Therefore we postulate that HD 191674 is a late type spotted dwarf rotating with a $5\overset{\text{d}}{.}21$ period.

Our observations of HD 191616 are plotted in Figure 5. with the error bars set to the standard deviation of the points during each night. The error of the nightly mean then would be about ten times smaller. Obviously HD 191616 is also a variable star, so Period98 (Sperl 1998) was used to find the period, amplitude and shape of the variations. The best model light curve found is of the form:

$$\Delta\text{R}=0.4611+0.0554*\sin(2\pi(\text{JD}-2112.0)/18.4638)+0.0198*\sin(2\pi(\text{JD}-2113.572)/9.2319)$$

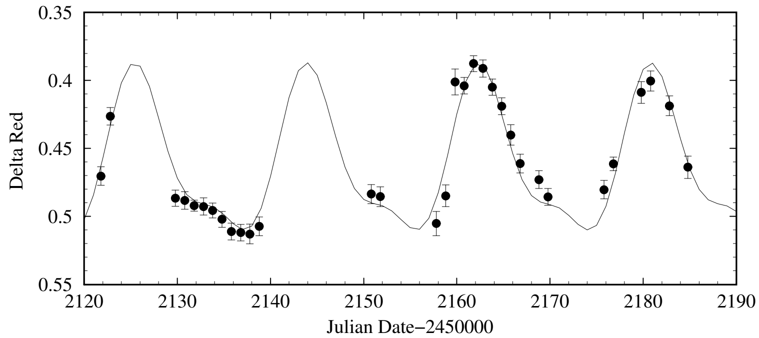

Figure 5. ΔR_c filtered light curve of HD 191616 for 2001 with model curve overplotted

Note that the second period was set to exactly half the dominant period, to modify the shape of the curve to best match the asymmetry in the distribution of the spots on the surface of the star. Spectroscopic observations made with the DAO 1.8m telescope were used to determine the spectral class to be K3, consistent with the $(R-I)_c$ and Tycho measurements. The spectrum displayed in figure 5 clearly shows the Hα emission line.

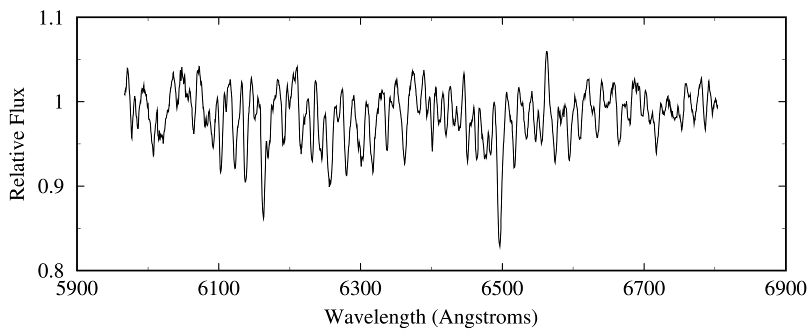

Figure 6. Spectrum of HD 191616 showing the Hα emission line at 6563$\mathring{A}$.

HD 191616 is an X-ray source, a K3 spectral type star with Hα emission, photometric variations with an $18\overset{\mathrm{d}}{.}5 \pm .4$ period and cycle to cycle differences typical of BY Dra stars. Photometric observations should be continued to monitor for flares, changes in the spot distribution and to determine the period more precisely.

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NEW TYPE AND ELEMENTS FOR THE ECLIPSING BINARY OT Cep

(BAV MITTEILUNGEN NO. 142)

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(2) Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D-12169 Berlin, Germany

Name of the object:
OT Cep

Equatorial coordinates:	**Equinox:**
R.A.= $0^h29^m18^s$ **DEC.=** $82°10'9''$	2000

Observatory and telescope:
Private observatory, 20-cm SCT

Detector:	SBIG ST6 camera
Filter(s):	none
Comparison star(s):	GSC 4504.583
Check star(s):	GSC 4504.663
Transformed to a standard system:	No

Availability of the data:
upon request

Type of variability:	EW

Acknowledgements:

This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France

Remarks:

Several observers tried to improve the elements of OT Cep (Blättler 1999, Nelson 2001). In order to get a complete lightcurve, OT Cep was put on our program. Soon it was clear, that the period has to be halved and it is an eclipsing binary of W UMa-type. The depths of the primary and secondary minima are very different. The light amplitudes are $0\overset{m}{.}69$ and $0\overset{m}{.}22$ respectively. The minimum times are calculated according to the Kwee–van Woerden method (Kwee, van Woerden 1956). A least squares fit to the data given in Table 1 led to the new ephemeris:

$$\text{Min I} = \text{HJD} \quad \underset{\pm 3}{2449169.4362} \; + \; \underset{\pm 1}{0\overset{d}{.}4812313} \cdot E \qquad (1)$$

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
OT Cep	49169.4354	.0005	I		-0.0008	[1]
	49641.5254	.0003	I		$+0.0013$	[2]
	50850.3762	.0010	I		-0.0009	[3]
	51363.3704	.0008	I		$+0.0007$	[4]
	51659.80612	.00005	I		-0.00206	[5]
	51913.4160	.0003	I		-0.0011	this paper
	51913.6596	.0009	II		$+0.0019$	this paper
	51922.3199	.0020	II		$+0.0000$	this paper
	51922.5586	.0003	I		-0.0019	this paper
	51955.5257	.0004	II		$+0.0009$	this paper

[1]: Hübscher, J. et al. 1994, [2]: Agerer, F., Hübscher, J. 1995,
[3]: Agerer, F., Hübscher, J. 1999, [4]: Blättler, E. 1999, [5]: Nelson, R.H. 2001

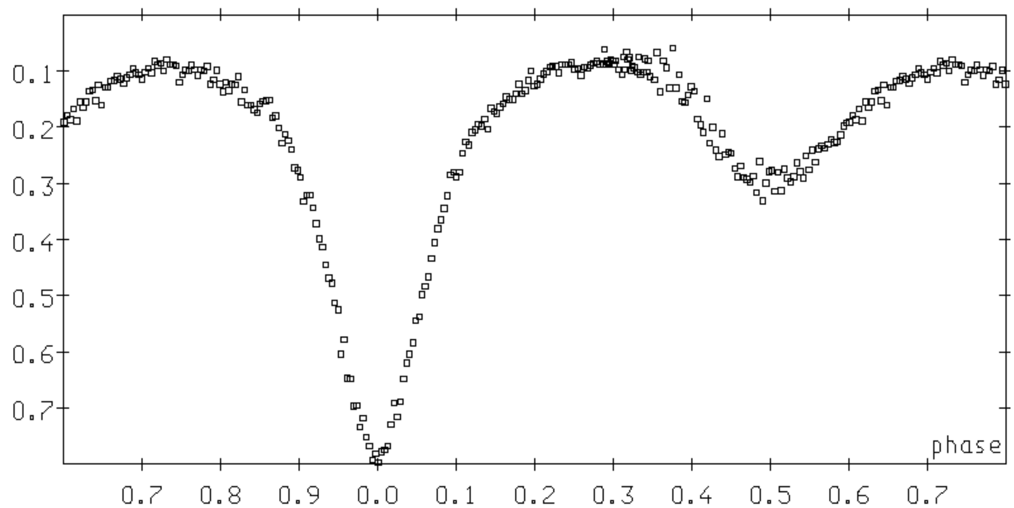

Figure 1. Differential light curve of OT Cep

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Agerer, F., Hübscher, J., 1999, IBVS 4711
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Kwee, K. K., van Woerden, H., 1956, *Bull. Astr. Inst. Netherlands,* **12**, No. 464, 327
Nelson, R.H., 2001, IBVS 5040

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ORBITAL ELEMENTS OF SB2 SYSTEM 66 Eri

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The first orbit of 66 Eri (EN Eri) was published by Frost & Struve (1924). They measured hydrogen-core lines and very few other lines. Young (1976) on the base of 15 radial velocities obtained from 13 Å/mm spectra have found a new orbit ($P_{orb}=5^{d}.522731$) and pointed that the chemical composition of the components is different. He used Frost & Struve (1924) radial velocities in combination with his own data to improve the determination of period. He used 24 separate line pairs for radial velocity measurements, including Fe II, Ti II, Ni II, Si II, Sr II, Ca II, Mg II lines.

Schneider (1987) observed 66 Eri in *uvby* photometric system and reported finding of weak variability ($0^{m}.002$ in v and $0^{m}.005$ in u) with the period of $7^{d}.8586$. In GCVS EN Eri is designated as a variable star of α^2 CVn type. The system has been observed in wide range of wavelengths from X-rays to far infrared.

Yushchenko et al. (1998) found the effective temperatures and surface gravities of the components (T_{effA}=11100±100 K, T_{effB} =10900±100 K, lgg=4.2 for both components) and found preliminary chemical composition of the components. Yushchenko et al. (1999) published detailed spectroscopic investigation of 66 Eri based on spectral observations with resolution $\Delta\lambda/\lambda$=36000. They determined chemical composition of the components, and it appeared that each component was a peculiar star, but each in a different way. Secondary component showed strong lines of heavy elements, while the primary one showed only a small overabundance of barium. Woolf & Lambert (1999) analyzed Hg abundances in a set of HgMn stars, using spectra with resolution $\Delta\lambda/\lambda$=160000-190000. They included 66 Eri B in their set of HgMn stars. 66 Eri A was included for comparison with 66 Eri B. Woolf & Lambert (1999) confirmed the different Hg abundances in the components of 66 Eri: 5.83 for component B and less than 2.2 for A.

Yushchenko et al (1999) analyzed *HIPPARCOS* photometry and found light variation with an amplitude near $0^{m}.005$. They tried to find the period of light variation, it appears that the period is equal to one half of orbital period and no significant peaks were found near $7^{d}.86$.

The phase shift of *HIPPARCOS* light curve plotted with the period equal to one half of the orbital period and two precision radial velocities obtained from spectra with resolving power 36,000 and S/N>100 (see Yushchenko et al., 1999) permit us to claim that our value of orbital period is more accurate than that given by Young (1976).

In this investigation we used 5 high-dispersion echelle spectra of 66 Eri obtained at 2.7 meter telescope of McDonald observatory with a spectral resolution of 60,000 and S/N ratio =>100. We used URAN software (Yushchenko, 1998) and synthetic spectra of the components calculated by Yushchenko et al. (1999) for processing the spectra and line identification. Only unblended lines of Fe II were used for radial velocity measurements. The technique of decomposition of a spectrum on Gaussian components was used (Casatella, 1976). This method permits one to find wavelengths of spectral lines with high precision. The obtained radial velocities were averaged with weights inversely proportional to the width of the spectral order contained a line used. Results of radial velocity measurements are given in Table 1, where one can find heliocentric Julian dates of the observations and exposure times (in seconds), mean radial velocities (in km/s), numbers of used lines and errors of weighted means (in km/s) for each component of the system.

Table 1. Radial velocities

$HJD_\odot$	Exposure	V_{r1}	N	σ	V_{r2}	N	σ
2450689.989	120	−79.5	19	0.2	+139.7	19	0.3
2450690.982	300	−4.6	17	0.2	+67.0	28	0.1
2450691.990	180	+96.3	22	0.3	−30.5	24	0.2
2450692.986	240	+124.6	14	0.2	−59.4	28	0.2
2450693.977	240	+57.7	27	0.2	+5.3	25	0.2

The orbital elements were obtained by a least-squares adjustment to our 5 radial velocities, 2 radial velocities obtained by Yushchenko et al. (1999) and 15 values from Young (1976), with weights inversely proportional to squares of their formal errors. The results and their errors are given in Table 2 together with Young (1976) results.

Table 2. Orbital elements of 66 Eri

	This work		Young (1976)	
P, $days$	5.522599	0.000006	5.522731	0.000009
T, $HJD_\odot$	2441384.11	0.05	2441384.13	0.1
e	0.087	0.004	0.095	0.01
w, ^{o}	160.3	3.4	161	6
K_1, km/s	102.7	0.7	103.8	1.3
K_2, km/s	100.5	0.7	100.7	0.7
γ, km/s	32.4	0.3	32.6	0.8
$a_1 sin\ i$, km/s	7.77×10^6	0.05×10^6	7.85×10^6	0.1×10^6
$a_2 sin\ i$, km/s	7.60×10^6	0.05×10^6	7.61×10^6	0.06×10^6
$M_1 sin^3 i$	2.35	0.03	2.38	0.05
$M_2 sin^3 i$	2.40	0.03	2.45	0.05
M_1/M_2	0.98		0.97	

The comparison of our results with Young's (1976) solution of the orbit shows an excellent agreement for all elements. The errors of our solution are significantly smaller.

Frost & Struve (1924) data are well fitted by our elements. Fig. 1 show all available observations of radial velocities of 66 Eri. Phases were calculated with our elements.

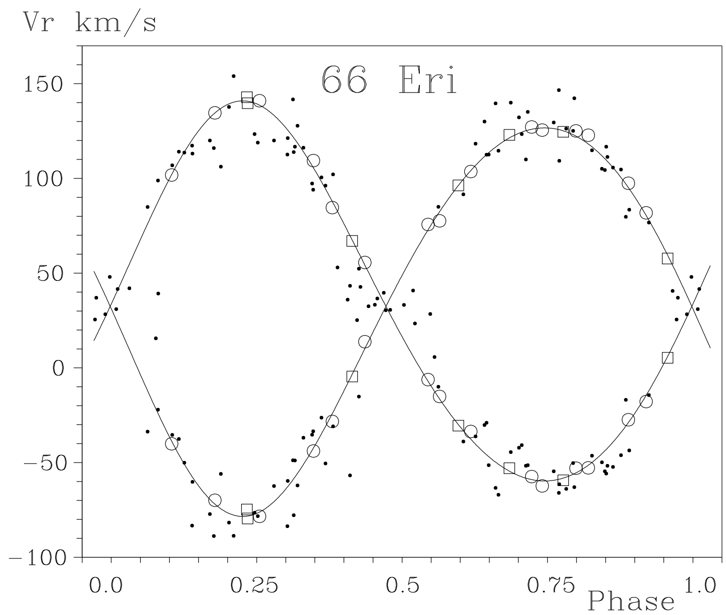

Figure 1. Radial velocity curves for 66 Eri. Solid lines are the velocity curves calculated with our new elements. Frost & Struve's (1924) data are marked by points, Young's (1976) data - by circles, data from Yushchenko et al. (1999) and this work are marked by squares.

The inclination of the orbit and hence the question of synchronization of rotation and orbital motion of the components of this binary still remains doubtful until the light variation found by Yushchenko et al. (1999) from *HIPPARCOS* data will be confirmed by more precise photometry and more reliable estimation of the distance will be available.

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UBVRI OBSERVATIONS OF V350 Cep IN THE PERIOD 1998-2001

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V350 Cep is a pre-main sequence star located in the region of active star formation NGC 7129. The long-term light curve of V350 Cep resembles the FUOR type stars (Semkov et al. 1999) but its spectrum is similar to the Classical T Tauri stars (Magakian et al. 1999). FUOR outburst is a very rare phenomenon and only three stars classified as FUORs (FU Ori, V 1515 Cyg and V 1057 Cyg) have well-studied light curves. Therefore, the photometric observations of FUORs and FUOR like stars are important for theoretical models fitting.

The present photometric data are a continuation of our investigation of V350 Cep (Semkov 1993; Semkov 1996; Semkov et al. 1999). Observations were made with tree telescopes: the 2-m RCC and 50/70/172 cm Schmidt telescopes of the National Astronomical Observatory Rozhen (Bulgaria) and 1.3-m RC telescope of the Skinakas Observatory[1] of the Institute of Astronomy, University of Crete (Greece).

Observations with 2-m RCC and 1.3-m telescopes were made with Photometrics CCD cameras 1024 × 1024 pixels. The size of the pixel is 24 μm and scale $0''.32$/pixel for 2-m RCC telescope and $0''.5$/pixel for 1.3-m RC telescope. All frames are bias subtracted and flat fielded. Observations with 50/70 cm Schmidt telescope were made with SBIG ST-8 CCD camera 1530 × 1020 pixels. The size of the pixel is 9 μm and scale $1''.1$/pixel. CCD frames obtained with the 50/70 cm Schmidt telescope were dark subtracted and flat fielded. All frames ware taken through a standard Johnson-Cousins set of filters. Aperture photometry was performed using IRAF/DAOPHOT[2] routines.

Pogosyants (1991) calibrated a sequence of comparison stars in the field of V 350 Cep. This sequence is not suitable for CCD photometric observations because the stars are calibrated only in BV bands using photographic observations. In order to facilitate transformation from instrumental measurement to the standard system nine stars from Pogosyants's sequence has been calibrated in UBVRI bands. Calibration was made during ten clear nights, five with 2-m RCC telescope and five with 1.3-m RC telescope. Standard stars from Landolt (1992) were used as reference. Table 1 contains the photometric data for UBVRI comparison sequence. The corresponding mean errors of the mean and number of observations for each star are listed also. The finding chart of the comparison sequence is present in Fig. 1. The chart is a reproduction from V frame obtained with

[1]Skinakas Observatory is a collaborate project of the University of Crete, the Foundation for Research and Technology - Hellas, and the Max-Planck-Institut für Extraterrestrishe Physik.

[2]IRAF is distributed by the NOAO, operated by the Association of Universities for Research in Astronomy Inc., under contract with the NSF.

the 1.3-m RC telescope on July 15, 2001. North is at the top and east is to the left. The original designations of stars given by Pogosyants (1991) are preserved.

The results from our CCD photometric observations are given in Table 2. The table contains the Julian Date, the V magnitude, $U-B$, $B-V$, $V-R$ and $V-I$ indices and the used telescope. The mean value of instrumental errors are $0\overset{m}{.}015$(I) and $0\overset{m}{.}019$(V) for observations made with Photometrics CCD cameras and $0\overset{m}{.}022$(I) and $0\overset{m}{.}029$(V) for observations made with ST-8 CCD camera. Fig. 2 shows the long-term B/pg- and V-band light curves of V350 Cep from all available photometric observations. In the figure open triangles denote our CCD photometric presented in this paper. Other symbols are as in Semkov et al. (1999). As seen from Fig. 2 the magnitude of V350 Cep during the period of observations is still near to the maximum value. Therefore, the star has been keeping its maximum brightness in the pass 25 years. The observed amplitude in V band is only $0\overset{m}{.}64$, a value typical for Weak line T Tauri stars.

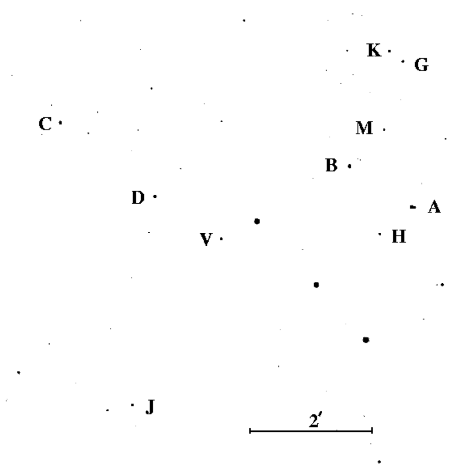

Figure 1. A finding chart of the comparison sequence in the field of V350 Cep

Table 1. Photometric data for UBVRI comparison sequence.

Star	V	σ_V	I	σ_I	$V-R$	σ_{V-R}	$B-V$	σ_{B-V}	$U-B$	σ_{U-B}	n
A	13.946	.031	13.065	.045	0.646	.051	0.770	.033	0.225	.062	7
B	14.568	.073	12.963	.066	0.815	.081	1.280	.105	0.410	.283	10
C	14.947	.054	13.935	.052	0.569	.078	0.924	.058	0.380	.084	10
D	15.332	.041	14.384	.066	0.503	.085	0.786	.050	0.205	.098	10
G	16.057	.033	14.628	.053	0.775	.091	1.202	.060	0.104	.152	6
H	16.317	.056	14.885	.068	0.746	.070	1.245	.065			10
J	16.250	.067	14.079	.050	1.004	.058	1.530	.084			9
K	16.938	.036	15.240	.061	0.857	.076	1.306	.039			6
M	16.623	.074	14.257	.068	1.193	.091	2.015	.097			10

Table 2. Photometric observations of V350 Cep in the period December 1998 - September 2001

J.D.(24...)	V	$U-B$	$B-V$	$V-R$	$V-I$	Tel.
51166.212	16.023	−0.16	1.030	0.926	2.011	2m
51225.608	16.047	−0.40	0.989	0.853	1.960	2m
51226.240	16.057	−0.22	1.008	0.919	1.948	2m
51226.593	15.946	−0.35	0.968	0.843	1.944	2m
51230.605	15.903	–	0.947	0.772	1.868	2m
51351.508	15.942	–	–	–	–	1.3m
51583.664	16.24	–	–	–	–	Scm
51611.609	16.461	–	–	–	2.183	2m
51709.524	16.287	−0.55	1.074	0.942	2.105	1.3m
51710.433	16.288	–	–	–	2.088	1.3m
51710.514	16.271	–	1.030	–	2.078	1.3m
51711.452	16.365	–	–	–	2.140	1.3m
51711.554	16.362	–	–	–	2.143	1.3m
51712.426	16.372	–	–	–	2.127	1.3m
51712.553	16.344	–	1.110	–	2.134	1.3m
51716.387	16.313	–	–	–	2.114	1.3m
51716.542	16.290	–	1.056	0.958	2.105	1.3m
51717.383	16.346	–	–	–	2.122	1.3m
51718.383	16.304	–	1.089	0.957	2.114	1.3m
51718.382	16.342	–	1.136	–	2.136	1.3m
51719.542	16.363	–	–	0.959	2.145	1.3m
51720.460	16.161	−0.20	1.085	0.934	2.022	1.3m
51736.547	16.168	−0.46	1.069	0.917	2.043	1.3m
51763.592	16.165	–	–	0.927	2.045	1.3m
51765.278	16.249	−0.25	1.093	0.961	2.111	1.3m
51765.599	16.272	–	–	–	–	1.3m
51766.274	16.261	−0.51	1.092	0.930	2.089	1.3m
51767.257	16.266	–	–	–	2.110	1.3m
51845.363	16.24	–	–	0.87	2.05	Scm
51847.310	16.28	–	1.08	0.90	2.15	Scm
51847.349	16.34	–	–	0.96	2.16	Scm
51903.322	16.11	–	1.08	0.86	2.01	Scm
52057.471	16.24	–	–	0.90	2.13	Scm
52095.530	16.264	−0.51	1.128	0.949	2.086	1.3m
52096.287	16.158	–	–	–	2.060	1.3m
52097.283	16.152	–	–	–	2.026	1.3m
52099.281	16.017	–	–	–	1.940	1.3m
52106.524	16.178	–	–	–	2.045	1.3m
52128.499	16.076	–	–	–	1.989	1.3m
52153.581	16.034	–	–	–	1.991	1.3m
52154.559	15.931	–	1.032	–	1.947	1.3m
52155.556	16.094	−0.27	0.988	–	2.011	1.3m
52156.559	15.931	−0.43	0.962	–	1.947	1.3m
52157.568	15.838	–	–	–	1.897	1.3m

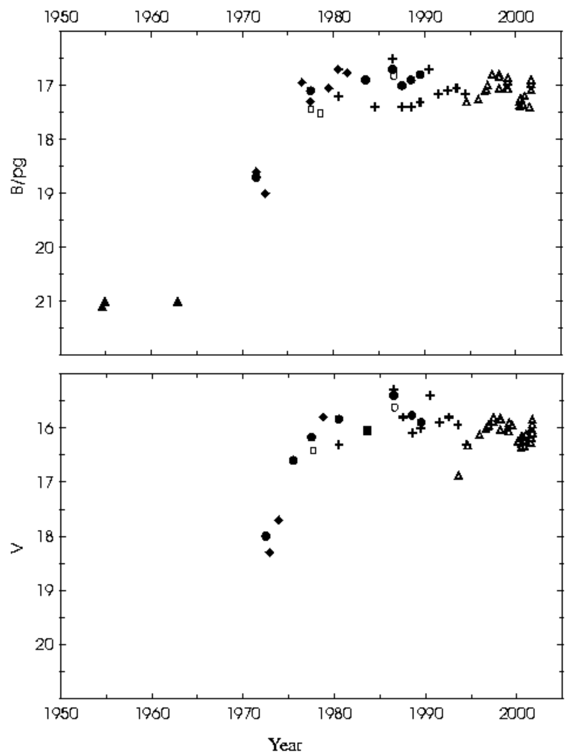

Figure 2. B/pg- and V-band light curves of V350 Cep

References:

Landolt, A.U., 1992, *AJ*, **104**, 340
Magakian, T.Y., Movsesian, T.A., Hovhannesian, E.R., 1999, *Astrofizika*, **42**, 121
Pogosyants, A.Yu., 1991, *IBVS*, No. 3624
Semkov, E.H., 1993, *IBVS*, No. 3825
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MACHINE READABLE CATALOG OF ODESSA PATROL PLATES

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The sky patrol of Odessa observatory was finished in 1998. In this short paper we will try to summarize the data about our plate collection.

The main part of our collection are plates of the 7-camera astrograph. In 1957-1998 near 84 000 plates were exposed. Total field of the view of the astrograph is about 30×80 degrees. With 30 minutes expositions the limiting magnitudes for plates obtained with yellow filter and without filter were $12^{\rm m}$ and $15^{\rm m}$. More detailed information about Odessa plate collections can be found in the papers of Tsesevich et al. (1989), Karetnikov et al. (1995) and Karamysh (1997).

It should be mentioned that there are also other plate collections in our observatory. First of all it is the Simeiz collection of 10 thousands plates, obtained in 1909-1953. We have near 10 thousands plates of other small astrographs of Odessa observatory, obtained during the decade before the beginning of the 7-camera astrograph patrol. The total number of glass plates in Odessa observatory is near 104 thousands. The sizes of the plates are 18×24 cm or smaller. Yushchenko et al. (1999) proposed the project of scanning the Odessa plates.

As a first step of this project we made a machine readable catalog of the plates of the 7-camera astrograph. The catalog contains the number of exposition, JD and calendar date, guiding star name, duration and average moment of exposition, observer's name. More than 300 observers took part in creation of our collection. Here we want to mention at least some of them (observer - no. of expositions):

Pikhun A.I. - 1475,	Bakumenko N.P. - 261,	Zaginaylo Yu.I. - 147,
Sotnikov V.P. - 1015,	Korovkina L.A. - 251,	Kazanasmas M.S. - 146,
Karamysh V.F. - 662,	Strelkova E.P. - 215,	Rublev S.V. - 146,
Fedotov Yu.T. - 509,	Fashchevskiy N.N. - 212,	Samsonova N.F. - 134,
Rudenko A.N. - 438,	Kashuba S.G. - 210,	Chuprina R.I. - 129,
Derevyagin V.G. - 392,	Kashuba V.I. - 208,	Kudashkina L.S. - 117,
Murnikov B.A. - 319,	Miskin N.A. - 176,	Marinovskiy L.F. - 116,
Mandel O.E. - 282,	Pogrebnoy G.D. - 161,	Yavorskiy Yu.B. - 103,
Pochinok B.D. - 271,	Makarenko E.N. - 154,	Komarov N.S. - 98.

The other files contain guide stars list, their coordinates and the numbers of expositions, and also the full observer's list with the numbers of individual expositions.

The catalog can be requested via e-mail (`yua@lens.tenet.odessa.ua`), and available at the IBVS website too (`5215-t1.txt` — `-t4.txt`). In the nearest future it will be placed on the website of Odessa observatory. Because of technical reasons this website is not available now.

References:

Karamysh V.F., 1997, Historical pages of astronomy in Odessa, part 4, 19, Astroprint, Odessa.

Karetnikov V.G., Markina A.K., Sotnikov V.P., 1995 in: Greiner et al., Proc. IAU Coll. 151, 1994, Sonneberg, Germany, Lecture Notes in Physics, **454**, 407

Tsesevich V.P., Romanov Yu.S., Chuprina R.I., Murnikov B.A., 1989, *Abastumani Astrophysical Observatory Bulletin*, **67**, 97

Yushchenko A.V., Karetnikov V.G., Chakhrukhanov O.C., Riabov A.V., Pikhun A.I., Kolesnikov S.V., 1999, *Acta Historica Astronomiae*, **6**, 74

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A NEW ECLIPSING BINARY IN SAGITTA

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Name of the object:
Secondary photometric standard No. 33 for WZ Sge (Henden and Honeycutt, 1997)

Equatorial coordinates:	**Equinox:**
R.A.= $20^h07^m36\overset{s}{.}2$ **DEC.=** $+17°44'50''$	J2000.0

Observatory and telescope:
40-cm astrograph in Crimea

Detector:	Photoplate

Filter(s):	None

Transformed to a standard system:	B_{pg}
Standard stars (field) used:	Based upon secondary standards from Henden and Honeycutt (1997)

Availability of the data:
Upon request

Type of variability:	EA

Remarks:
During a study of WZ Sge based upon secondary photometric standards suggested by Henden and Honeycutt (1997), strong fadings were found for the standard No. 33. The finding chart is presented in Fig. 1. I estimated the star on 360 plates (JD 2433162–2449623). The following light elements were derived for this EA variable: Min = JD2442637.341 + $1\overset{d}{.}910400 \times E$. The star's brightness changes between $14\overset{m}{.}25$ and $15\overset{m}{.}30$. The duration of the eclipse is about 5 hours.

Acknowledgements:
Thanks are due to S.V. Antipin and N.N. Samus for their attention and assistance.

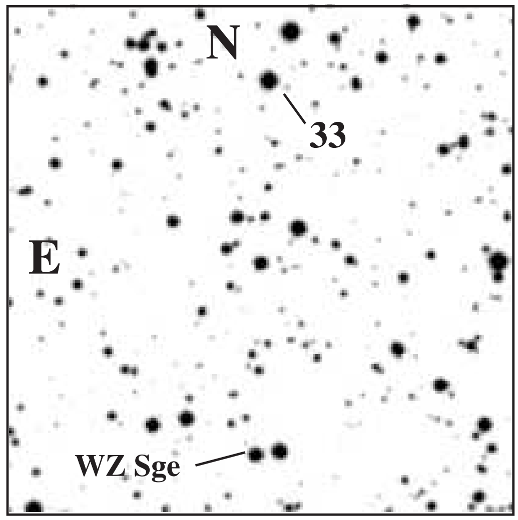

Figure 1. The finding chart of the new variable (3.′5 × 0.′5).

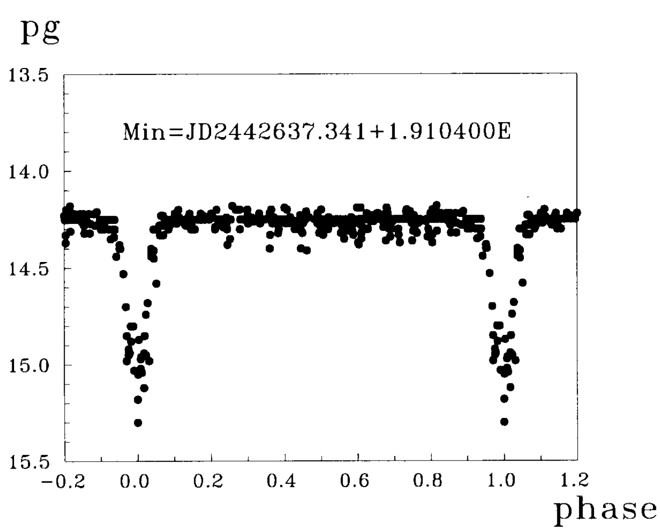

Figure 2. The light curve of the new variable.

Reference:

Henden, A.A., Honeycutt, R.K. 1997, Publ. Astron. Soc. Pacif., **109**, 441

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THE PERIODS OF THE SEMIREGULAR VARIABLE V370 And

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V370 And (HD 11979, HIP 9234, $01^{h}58^{m}44\overset{s}{.}33$ $+45°26'06\overset{''}{.}9$ (2000)) is a bright, $V = 7\overset{m}{.}60$, late-type giant of spectral type M7 III. It is one of the variables discovered by Hipparcos and was initially classified as In, probably on the basis of a single bright excursion. The range is a little over one magnitude. Closer inspection of the Hipparcos light curve suggests coherent variations on a time scale of 200-300 days which led Hoffleit (1998) to suggest that it is an SRV with a period of around 240 days. A periodogram of the Hipparcos data shows a clear period near 228 days, but the phase diagram, in Figure 1, shows some particularly large deviations around maximum light. From the light curve, shown in Figure 2, it is clear that these deviations are not simply due to alternately high and low maxima. The light curve also reveals small, but significant, features that are inconsistent with a single period and suggest variations on a shorter time scale. When the principal period is removed the dominant remaining period is approximately half this value, but it is clearly not a simple harmonic. This period ratio of $\sim 2:1$ is seen in approximately half the semiregular variables (Kiss et al. 1999). The best two-period fit yields periods of 228 ± 1 and 123 ± 1 days, with amplitudes of $0\overset{m}{.}32$ and $0\overset{m}{.}20$ respectively, giving the longer period the larger amplitude. A least squares fit to the data is shown in Figure 2.

In an effort to follow the earlier behaviour of V370 And, additional observations have been taken from the films of the Hewitt Camera Archive held by the Variable Star Section of the British Astronomical Association. Details of the Hewitt Camera and film archive are given by Howarth (1992). The films are unfiltered and a variety of panchromatic emulsions have been used, Ilford HP3, FP4, HPS and Kodak Professional Royal Pan 4141, which are sensitive from below 4500Å to above 6000Å. As the images are trailed they cover more emulsion, are less saturated and are easier to estimate than point images. Previous experience suggests that photometry from the archive films is particularly consistent for this type of medium, with $\sigma < 0\overset{m}{.}1$ over small ranges of $\sim 0\overset{m}{.}5$.

The magnitude of V370 And has been estimated visually, using a fixed microscope and light table, on 20 films taken between 1971 and 1989. The comparison star details, given in Table 1, are taken from the Hipparcos catalogue (Perryman et al. 1997). The light curve, in Figure 3, shows a range of variation of $1\overset{m}{.}5$ which is slightly larger than the Hipparcos data, but again this is due mostly to a single bright excursion. Generally the variation is within $0\overset{m}{.}5$. Unfortunately the photographic observations are rather sparse and it is not possible to follow the variations of the star. The periodogram of the photographic

Table 1: V370 And comparison stars information

Comparison	V	Sp	Comparison	V	Sp
HD 11884 = GSC 03284-00763	6.48	K0	HD 13076 = GSC 03281-01262	7.59	F5
HD 11188 = GSC 03283-01694	7.27	B8	HD 12157 = GSC 02841-00508	7.66	G5
HD 11252 = GSC 03283-00900	7.45	G5	HD 11969 = GSC 03280-00350	7.99	K5

data is not surprisingly dominated by noise, with only the weakest indication of the 228-day period. To refine the period the photographic and Hipparcos data have been simply combined and this ephemeris has been used to produce the phase diagram of the photographic data in Figure 4. Most of the points are distributed in the fainter half of the light curve but even so there is very little sign of the periodic variation.

The photographic observations of V370 And over some 18 years show the same behaviour as the Hipparcos data, a basic variation of $\sim 0^{m}5$ with brighter excursions. However, there is no compelling evidence to suggest that the dominant period visible in the Hipparcos data was also present at that time. A single period would probably have been revealed, and in semiregular variables with two periods, the dominant period is usually visible in all sensible subsets of the data. However, in this case is possible that there are too few observations to reveal this period against the competing variations.

V370 And would clearly benefit from an analysis of many more observations over a longer period, but as a complex, relatively low-amplitude, variable a few seasons of photoelectric photometry would probably yield much about the nature of its variations.

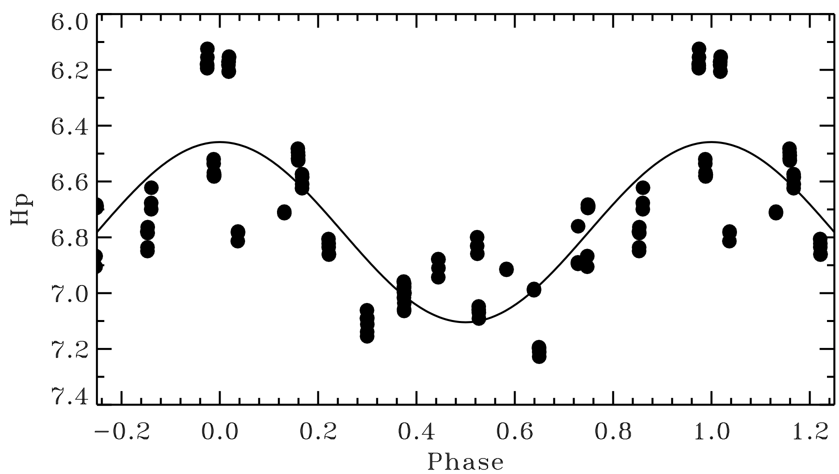

Figure 1. The phase diagram of the Hipparcos data folded with the 228-day period.

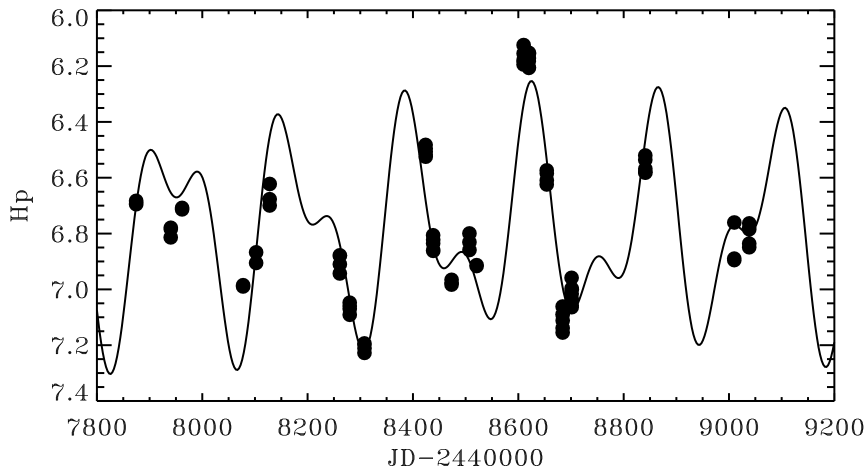

Figure 2. The light curve of the Hipparcos data from 1990 – 1992 with the two-period fit over plotted.

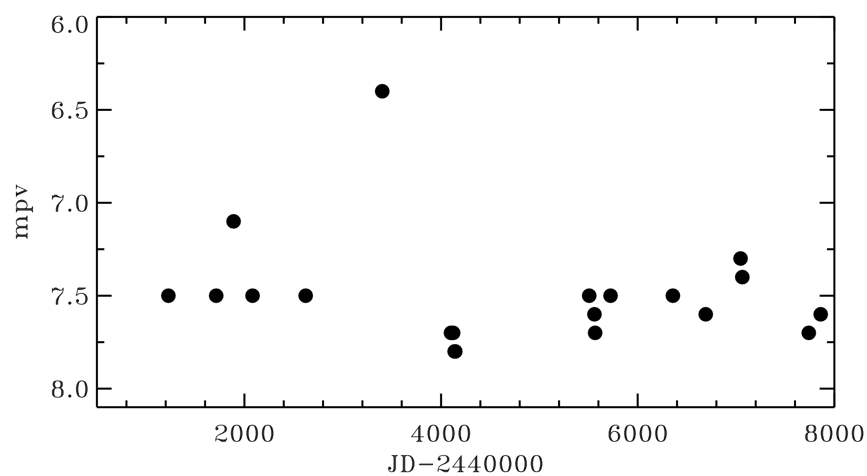

Figure 3. The light curve of the photographic data from 1971 – 1989.

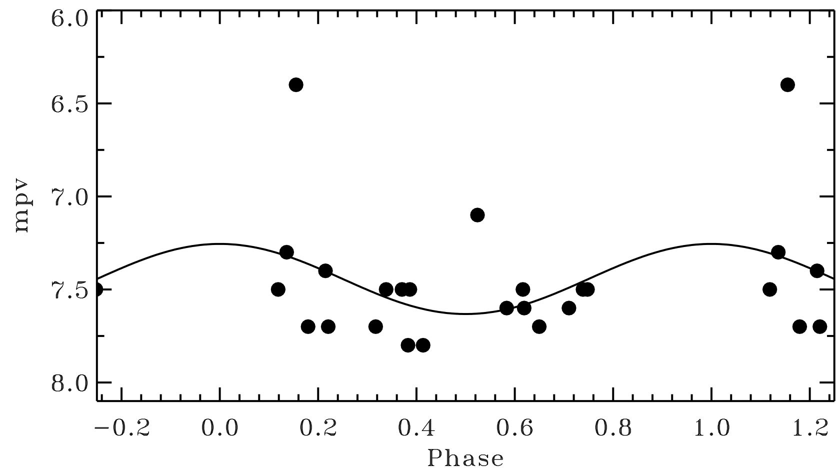

Figure 4. The phase diagram of the photographic data folded with the 228-day period. This plot has the same phasing as Figure 1.

References:

Hoffleit D., 1998, *IBVS*, No. **4630**
Howarth J.J, 1992, *J.BAA*, **102**, 343
Kiss L.L., Szatmáry K., Cadmus Jr. R.R., Mattei J.A., 1999, *A&A*, **346**, 542
Perryman M.A.C. et al., 1997, *The Hipparcos and Tycho Catalogue*, ESA SP-1200

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04 January 2002
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NN Ser AND V664 Cas: TWO PRE-CATACLYSMIC BINARIES WITH LARGE REFLECTION EFFECT

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Pre-cataclysmic binaries (Ritter & Kolb 1998; Marsh 2000; Hillwig et al. 2000) constitute a small group of detached short-period systems formed from wide binaries during the common-envelope stage of evolution (Paczyński 1976). They usually consist of a hot white dwarf and a low-mass cool main-sequence secondary. The systems become further the cataclysmic ones loosing angular momentum via gravitational waves and/or magnetic braking (Ritter 1986). The light curves of many pre-cataclysmic variables exhibit large variations caused by the reflection effect. This is a consequence of large temperature differences at the secondary's surface which are caused by the heating of its hemisphere by a hot companion. The full amplitude of the reflection effect exceeds 1 mag in some systems. The study of the reflection effect, especially when observed in several bands, can help to constrain system's parameters. This is very important in systems which are non-eclipsing.

We observed two relatively poorly studied pre-cataclysmic stars, NN Ser and V664 Cas. All observations were carried out at the Białków station of the Wrocław University Observatory with a 60-cm Cassegrain telescope equipped with a 576 × 384 pixels CCD camera, an autoguider, and a set of $UBV(RI)_{\rm C}$ filters of the Johnson-Cousins system. For both stars differential magnitudes with respect to nearby relatively bright stars of similar colour have been formed. The differential photometry was left in the instrumental system.

Using the positions of stars from the Hubble Guide Star Catalog, we derived the positions of NN Ser and V664 Cas with an accuracy $\sim$0$''\!\!.$1. They are the following: NN Ser, $\alpha_{2000.0} = 15^{\rm h}52^{\rm m}56\overset{\rm s}{.}12$, $\delta_{2000.0} = +12^\circ54'44''\!\!.3$, V664 Cas (GSC 4056.01762), $\alpha_{2000.0} = 3^{\rm h}03^{\rm m}47\overset{\rm s}{.}01$, $\delta_{2000.0} = +64^\circ54'36''\!\!.2$. The photometric data for NN Ser and V664 Cas presented here are available from the authors upon request.

The photometric variations of NN Ser (PG 1550+131), a $V \approx 17$ mag pre-cataclysmic variable, were revealed by Wilson et al. (1986) and Häfner (1989). The star shows nearly sinusoidal variations due to the reflection effect and a very deep 10.5 min-long primary eclipse. Because the star is very faint, the true shape and depth of the eclipse was not known until the recent observations with the VLT ANTU by Häfner (2000) on 10/11 June 1999. The 18.5-min trail exposure showed clearly that the eclipse is total and has a record depth equal to 6.04 mag in the V filter.

We observed NN Ser on one night, 2/3 May 2000, in two bands, V and $I_{\rm C}$. The star was too faint for our telescope to be seen within the eclipse, but the out-of-eclipse variations could easily be recorded. They are shown in Fig. 1 together with synthetic light changes. The latter were obtained by means of the Wilson-Devinney code (Wilson & Devinney 1971) with parameters taken from Häfner (2000). Our photometry is not good enough to improve system parameters given by this author, but the I_C observations we provide are the first presented for NN Ser in filter other than V. As expected, the reflection effect in the I_C light curve has a range of about 1 mag in comparison with about 0.6 mag in V. From our out-of-eclipse observations in the V filter we derived the time of minimum light: HJD 2 451 667.4771 ± .0004. The time of mid-eclipse was derived by means of the least-squares shifting the synthetic light curve (shown in Fig. 1) in time. Only the V observations were used for that. Four other times of minimum are available from the literature (Table 1). All times of minimum resulted in the following ephemeris for the primary eclipse in NN Ser:

$$T_{\rm min}\,{\rm I} = {\rm HJD}\ 2\,447\,344.52413(11) + 0\overset{\rm d}{.}13008010(2)E, \qquad (1)$$

where the numbers in parentheses denote the r.m.s. errors of the last digit(s) and E is the number of cycles elapsed from the starting epoch.

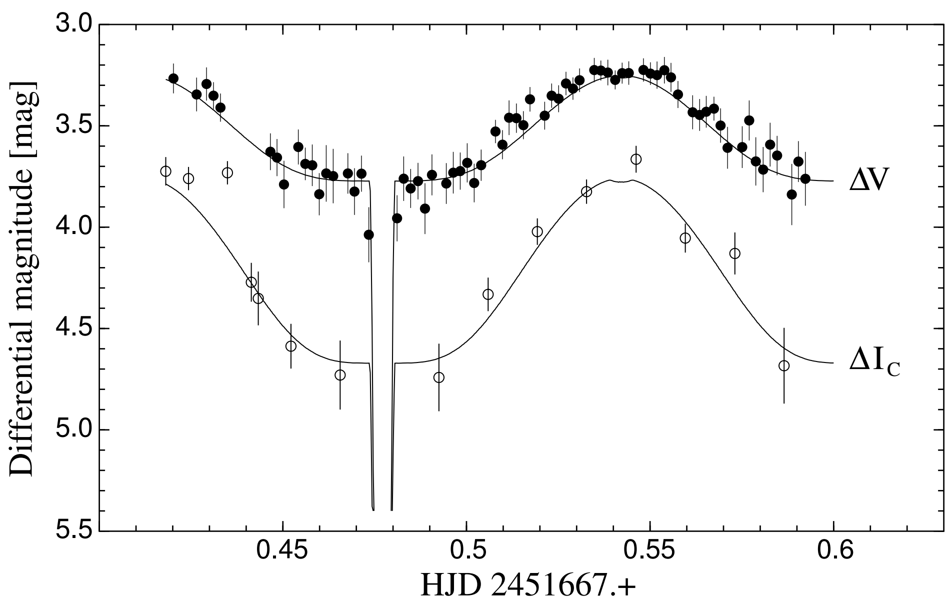

Figure 1. Differential V (dots) and I_C-filter (open circles) light curve of NN Ser obtained on 2/3 May 2000. In order to indicate the location of the eclipse, synthetic changes are also shown with continuous line.

Table 1. Times of primary minimum for NN Ser

Time of minimum HJD 2 400 000.+	E	O−C [d]	Reference
47344.5240(5)	0	−.00013	Häfner (1989)
47712.78093(5)	2831	+.00004	Wood & Marsh (1991)
47713.82158(5)	2839	+.00005	Wood & Marsh (1991)
48301.91353(5)	7360	−.00013	Wood & Marsh (1991)
51667.4771(4)	33233	+.00101	this paper

The variability of V664 Cas, the central object of the faint planetary nebula HFG 1 (Heckathorn et al. 1982) was found by Grauer et al. (1987). They derived a period of $0^{d}_{.}5817$ and the range of about 1.1 mag in B filter. The light curve they show is nearly sinusoidal. Despite the large variations, the variability is entirely due to the reflection effect. The system is non-eclipsing (Grauer el al. 1987). As far as we are aware, no other photometry is available for this star.

V664 Cas was observed by us on two consecutive nights, 18/19 and 19/20 October 1999 through the V, R_C, and I_C filters. These observations phased with the period derived by Grauer et al. (1987) are shown in Fig. 2. Although the phases near minimum were not covered, it is clear that the light curve is, likewise in the B filter, nearly sinusoidal. It can be also seen that the range of the reflection effect is nearly the same in all three filters. Fitting a sinusoid we derived the range of $1.132 \pm .012$, $1.140 \pm .008$, and $1.118 \pm .006$ mag in V, R_C, and I_C, respectively. The average time of maximum light derived from our data in all three filters is the following: HJD 2 451 470.5241 ± .0004. Unfortunately, we cannot improve the period derived by Grauer et al. (1987), because the time of maximum light is not available for their observations.

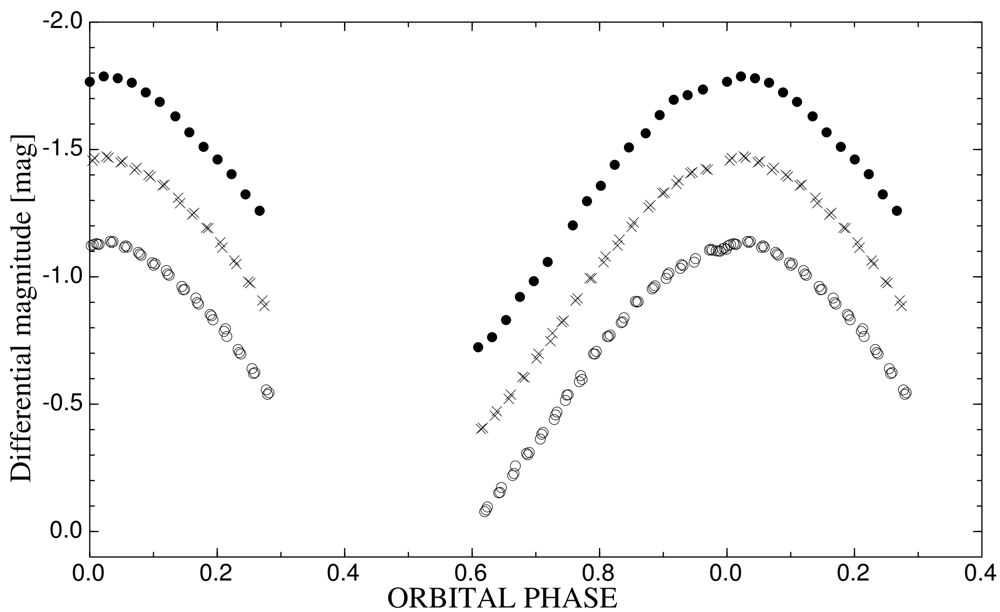

Figure 2. Differential light curve of V664 Cas in V (dots), R_C (crosses), and I_C (open circles) band phased with a period of 0.5817 d derived by Grauer et al. (1987). Phase 0.0 was chosen arbitrarily.

As was shown by Acker & Stenholm (1990), the optical spectrum of V664 Cas is dominated by strong emission lines coming from the secondary's heated hemisphere. The effective temperature of the primary estimated from its ultraviolet spectrum was found to be in the range 50 000–60 000 K (Heckathorn & Fesen 1985). It is therefore likely a hot white dwarf. The diameter of the primary cannot be constrained from the analysis of the light curve because the system is non-eclipsing. Nevertheless, we have tried to fit the $V(RI)_C$ light curves using again the Wilson-Devinney code. We found that the only parameter which can be reliably estimated is the inclination of the orbit which amounts to about 30°.

There are several pre-cataclysmic binaries which, like V664 Cas, show large reflection effect. These are: BE UMa, TW Crv, FF Aqr, VW Pyx, V 474 Lyr, UU Sge, and NN Ser.

However, except maybe VW Pyx (Kohoutek & Schnur 1982; Bond 1988), the amplitude of the reflection effect increases towards longer wavelengths. In this respect, V664 Cas seems to be exceptional. Its large reflection effect with amplitudes practically independent of the wavelength in the optical range can be qualitatively explained if we recall two facts: (i) the main contribution to the total light comes from the heated secondary's hemisphere not the primary component, (ii) there is a strong gradient of the surface brightness in the heated hemisphere. In general, for a given system, the larger the inclination, the larger the amplitude of the reflection effect is. So, how we can get a 1.1-mag reflection effect in such a low-inclination system like V664 Cas? Simple comparison of the areas of the heated hemisphere seen by the observer at the epochs of maximum and minimum light is not sufficient to explain this. However, we have to remember the fact (ii) which means that in the phases around the maximum light we see very hot areas nearby the substellar point. This is not the case in the minimum, when we see only much colder areas of the heated hemisphere. Moreover, if we consider only the contribution of the secondary, we should observe the *increase* of amplitude with decreasing wavelength. However, there is a primary in the system. Because it is hot, its contribution is larger in short wavelengths. This leads to the reduction of the amplitude calculated from the contribution of the secondary. In V664 Cas the two effects balance perfectly, leading to the independence of the observed amplitude of the reflection effect of the wavelength in the optical range.

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Wood, J.H., Marsh, T.R., 1991, *ApJ*, **381**, 551.

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GSC 628_290: A NEW EW/KW VARIABLE

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[2] Ramonville Saint Agne Observatory, 10 Domaine de la Chêneraie, F-31520 Ramonville Saint Agne, France, email: christian.buil@wanadoo.fr

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[4] Village-Neuf Observatory, 9 rue de Huningue, F-68300 Saint-Louis, France, email: sky.walker@wanadoo.fr

Name of the object:
GSC 628_290

Equatorial coordinates:	**Equinox:**
R.A.= $01^h48^m43^s\!.64$ **DEC.=** $+13°04'11''\!.6$	J2000

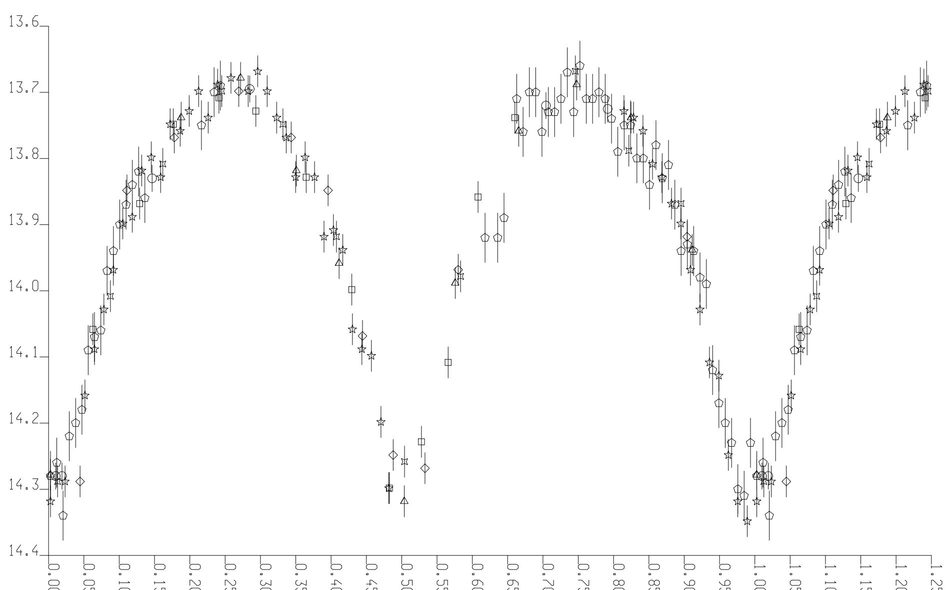

Figure 1. Unfiltered light curve of GSC 628_290

Observatory and telescope:
Ramonville Saint Agne Observatory (IAU astrometric code 959), 0.19m f/d=4 reflector Bedoin Observatory (code 132), 0.16m f/d=3.5 reflector Village-Neuf Observatory (code 138), 0.20m f/d=6.3 Schmidt–Cassegrain telescope

Detector:	KAF 400 CCD at 959 and 132, KAF 401e CCD at 138

Filter(s):	None, roughly R

Transformed to a standard system:	No

Availability of the data:
Upon request

Remarks:

The variability of GSC 628_290 was found by Buil on CCD frames taken around 1998-08-29 (circles in Figure 1), during a test of implementation in his `Iris` software of an optimal image subtraction algorithm for supernovae photometry. Antonini made several series of observations (1998-11-06, squares; 1998-11-07, diamonds; 1998-11-20, 4-branches stars; 1998-11-24, triangles; 1998-12-07, 5-branches stars) to establish the light curve and a preliminary period. Demeautis observed GSC 628_290 on 2001-10-12 (pentagons) to confirm the light curve and to better determine the period. The eighth order Fourier sum that was adjusted on the observations includes two additional constants to account at the first level of approximation for the different (unfiltered) photometric systems of each observer. The mean magnitude, the sixteen parameters of the periodic terms, the two constants, and the period are solved by least square technics using all the observations and their uncertainties. The time of a minimum is computed by a cut in the adjusted Fourier series near the principle minimum. The resulting light curve is shown in Figure 1. The numerical values obtained with the `CourbRot` software (Behrend, 2001) are as follows:

$$\begin{aligned} \text{HJD of a principal minimum} &= 2452194.8429 \pm 0.0006 \\ \text{Period} &= 0^{\text{d}}.38176699 \pm 0^{\text{d}}.00000025 \\ \text{Total variation} &= 0.63 \pm 0.01\,\text{mag} \end{aligned}$$

The shape of the light curve indicates that the variability type of GSC 628_290 is probably EW/KW.

Reference:

Behrend, R., 2001, *Orion*, **304**, 12

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CCD MINIMA OF SELECTED BINARY STARS IN 2001

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Observatory and telescope:
40-cm $f/5$ Newton telescope of the Paolo Pizzinato Private Astronomical Observatory (Bologna, Italy)

Detector:	HiSis-23 CCD camera, thermoelectrically cooled, KAF-400 chip, unfiltered

Method of data reduction:
Reduction of the CCD frames was made with Astroart[1] package.

Method of minimum determination:
The minima times were computed with Kwee-van Woerden (1956) method using a separate software available on the World Wide Web.

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
AD And	EW	23 36 44	+48 40 19		43045.856	0.98619023	1
DD Aqr	EB	22 45 52	+01 02 54		28395.162	0.7210107	1
TW CrB	EB	16 06 51	+29 16 01		43295.3925	0.58887477	1
WZ Cyg	EB	20 53 06	+38 49 42		48073.4680	0.5844691	1
AE Cyg	EA	21 13 14	+30 44 25		44586.229	0.96918718	1
CG Cyg	RS	20 58 13	+35 10 28		45892.442	0.6311435	1
DK Cyg	EW	21 35 02	+34 35 44		49918.4467	0.47069290	1
V387 Cyg	EA	21 15 36	+37 30 02		50333.312	0.6405964	1
V456 Cyg	EA	20 28 50	+39 09 15		48768.457	0.8911966	1
TT Her	EB	16 54 23	+16 50 12		48839.4108	0.91207944	1
V839 Oph	EW	18 09 21	+09 09 06		49536.3915	0.40900516	1
BN Peg	EA	21 28 02	+05 00 13		50003.3540	0.713298	1
BX Peg	EW	21 38 53	+26 42 23		48174.5310	0.28041747	1
BU Vul	EA	20 46 18	+28 15 44		50681.434	0.56899379	1

Source(s) of the ephemeris:
1. Rocznik Astronomiczny Obserwatorium Krakowskiego ephemerides (SAC 72, 2001).

[1]Astroart is a copyright by MSB Software.

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
AD And	52151.4062	0.0022	I	–	−0.0304	
DD Aqr	52173.4541	0.0011	I	–	−0.0087	
TW Crb	52147.3747	0.0002	I	–	0.0167	
WZ Cyg	52134.3673	0.0004	I	–	0.0046	
AE Cyg	52131.3486	0.0011	I	–	−0.0066	
CG Cyg	52129.3435	0.0005	I	–	−0.0622	
DK Cyg	52144.3613	0.0006	I	–	−0.0170	
V387 Cyg	52149.4076	0.0003	I	–	0.0012	
	52158.3775	0.0006	I	–	0.0026	
V456 Cyg	52135.3909	0.0002	I	–	−0.0101	
TT Her	52149.3434	0.0021	I	–	−0.0041	
V839 Oph	52143.3865	0.0012	I	–	−0.0067	
	52150.3345	0.0021	I	–	−0.0113	
BN Peg	52145.3848	0.0009	I	–	−0.0087	
BX Peg	52121.4212	0.0003	I	–	0.0104	
BU Vul	52124.4077	0.0003	I	–	0.0014	
	52136.3578	0.0009	I	–	0.0025	

Acknowledgements:

We would like to thank Dr. Robert H. Nelson for his software EBmin to calculate predictions of the EB star minima.

References:

Kwee, K. K., & van Woerden, H., 1956, *Bull. Astron. Inst. Neth.*, **12**, 327

SAC 2001, Supplemento ad Annuario Cracoviense 72

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GSC 01621-02192: A NEW W UMa ECLIPSING BINARY

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During a campaign of photometry on the outburst of WZ Sge in the summer of 2001, we discovered one of the stars in the field to be an eclipsing variable star of the W UMa type. We observed the star on 15 nights between July 25 and September 4, 2001, at the RIT Observatory (latitude +43.0758 North, longitude 77.6647 West, altitude 168 m). We made all measurements with a 25-cm Meade LX200 Schmidt-Cassegrain telescope at f/6.3 and SBIG ST-8E CCD camera equipped with BVI_C filters made to the prescription of Bessell (1990) to match the Johnson-Cousins system. Our exposure times ranged from 10 to 20 seconds. We performed aperture photometry with radii of 8.8 arcsec at early times (before August 16) and 6.6 arcsec at later times.

The raw instrumental magnitudes were combined using the inhomogeneous ensemble method of Honeycutt (1992), so that all the stars in the field (roughly 100) were used as comparisons. The ensemble method yields differential magnitudes with an arbitrary zero-point; we used HD 191083 to set the zero point of the magnitude scale, adopting the calibration of Henden and Landolt (2001). The data are available upon request from the author.

The position of the system appears in the GSC2.2 as (J2000) RA = 20:07:55.39, Dec = +17:31:16.5. Comparing positions from USNO-A2.0, GSC2.2, and 2MASS, we find a proper motion in Declination of $-0''.022 \pm 0''.003$ per year. A finding chart appears in Figure 1.

We used the PERIOD analysis package within STARLINK to determine the period of the system. Combining V-band data from 5 nights spanning a month yields 0.3690 ± 0.0006 days. See Figure 2 for light curves in B, V and I. The time of primary minimum is difficult to determine from our measurements, due to the low signal-to-noise ratio in each measurement. We estimate one time of primary minimum to be HJD 2452122.660 ± 0.002.

Our measurements of the magnitudes of the system at maximum light and the depth of the primary eclipse are shown in Table 1. The secondary minima are only slightly shallower than the primary minima: the difference is at most 0.1 mag.

We gratefully acknowledge the data analysis facilities provided by the Starlink Project, which is run by CCLRC on behalf of PPARC.

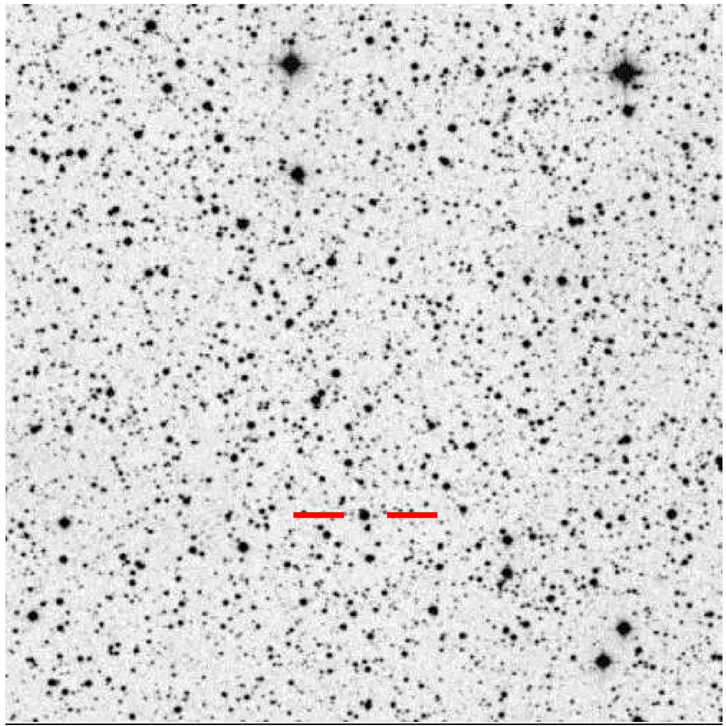

Figure 1. Finding chart for new variable; N up, E left, field is $14' \times 14'$.

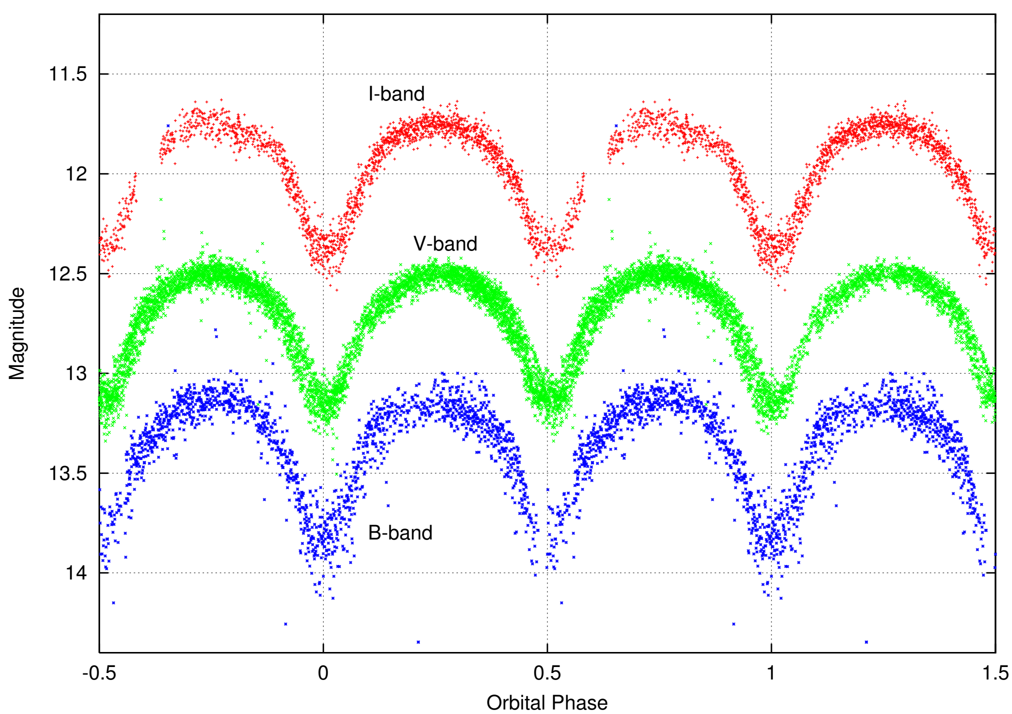

Figure 2. Light curves of new variable star

Table 1: Photometric properties of the light curve.

Passband	Max. brightness	Depth of primary eclipse
B	13.11 ± 0.03	0.70 ± 0.03
V	12.50 ± 0.02	0.69 ± 0.02
I_C	11.76 ± 0.02	0.65 ± 0.02

References:

Bessell, M. S., 1990, *PASP*, **102**, 1181
Henden, A. A., Landolt, A. U., 2001, *IBVS*, 5166
Honeycutt, R. K., 1992, *PASP*, **104**, 435

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J AND K INFRARED LIGHT CURVES OF THE ACTIVE BINARY BH Vir

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We have carried out a monitoring program devoted to the photometric infrared observation of active RS CVn short-period systems (Arévalo, 1994). These binaries display vast solar-type activity phenomena. Over the last two decades efforts have been made to understand the nature of this activity. One aim of these studies has been to model the physical properties of starspots evident from distorted photometric light curves. Once the distortion wave are removed the clean light curves are analyzed with the aim of determining reliable parameters. For this reason it is important to analyze IR light curves in order to determine the physical parameters of these binaries. Light curves observed in the infrared bands have revealed that this spectral region is not exempt from the known variability presented in the visible spectral range, but it seems clear that the amplitude of the observed irregularities in the light curves generally decreases at longer wavelengths (Arévalo, 1994).

Before discussing the results it is interesting to give a summary of some of the known features of BH Vir, currently considered a member of the RS CVn short-period group. Photometric visible light curves have been published regularly since 1957 (See Zeilik *et al.* 1990 and Xiang, Deng and Liu 2000, for references). Zeilik *et al.* (1990) studied all the visible photometric light curves observed from 1953 to 1986 parameterizing the photometric distortion waves presented in the light curves of BH Vir by a dark circular spot model on the primary star. When the starspot contribution was subtracted from the light curves the latter were analyzed in order to obtain the physical parameters. Later Xiang, Deng and Liu (2000) modeled the photometric distortion, also considering active regions on the secondary star. Complete Strömgren *uvby* light curves with the distortion wave removed were analyzed by Clement *et al.* (1997), who concluded that BH Vir appears to be a binary system with G0 and G2 main sequence solar-type stars. There are slight disagreements among the results of the analysis performed by different authors using different fitting programs. Vincent, Piskunov and Tuominen (1993), by means of surface imaging technique, pointed out that BH Vir has a total secondary eclipse.

Concerning spectroscopic mass ratio $q = m_2/m_1$ determination, different authors give different values, ranging from 1.02 to 0.903 (e.g., Abt 1965; Popper 1997; Xiang, Deng and Liu, 2000). From photometric and spectroscopic studies, it seems that the primary component in BH Vir is approaching the end of its main sequence life.

The observations presented in this paper were performed over 7 nights in 1998 March and June with the 1.5 m Carlos Sanchez Telescope at the Observatorio del Teide (Canary Islands, Spain) (Table 1). We used a CVF photometer with a focal plane chopper, an InSb detector cooled with liquid nitrogen and standard broadband J and K filters. Both the chopping amplitudes and the aperture diameter were 15″. The estimated photometry errors were less than 0.01 mag. The main comparison star was HD 121299. The orbital phases were calculated using the ephemeris given by Koch (1967); namely, Min I (HJD)= 2438107.19047+$0^{d}_{.}81687099$E. The orbital period of BH Vir shows no obvious changes, as was determined by Xiang, Deng and Liu (2000).

Our infrared light curves show equal maxima, especially in the K filter. In order to determine new geometrical elements from the IR light curves, we used the code developed by Budding and Zeilik (1987). This program, based on the Information Limit Optimization Technique (ILOT), is extensively described in Banks (1993) and references therein. The limb darkening coefficients were interpolated from the values given by Claret *et al.* (1995). The mean stellar surface temperatures used to calculate the gravity darkening exponents were $T_1 = 6100$ K and $T_2 = 5800$ K. We attempted to find solutions assuming an initial set of parameter values corresponding to the previously existing determinations. In fact, the radii ratio $k = r_2/r_1$ was varied as an initial parameter from 0.80–1.10. Solutions with a radius ratio in the range 0.91–0.97 fit the observed light curves well, but the smallest χ^2 corresponds to the lower 0.92 value. The inclination angle was always very close to 87°. The infrared light curve solutions are in good agreement with Zeilik *et al.* (1990) determinations from the UBVRI light curves ILOT analysis. In order to stand out these results, in Table 2 we have included Zeilik *et al.* (1990) solutions together with our J and K accepted parameters. The J and K filter models are plotted with the observations in Figure 1.

Table 1: Observing runs

Observation date	Observed Filters
1–2 March 1998	J, K
2–3 March 1998	J, K
8–9 March 1998	J, K
13–14 March 1998	J, K
14–15 March 1998	J, K
3–4 June 1998	J, K
10–11 June 1998	J, K

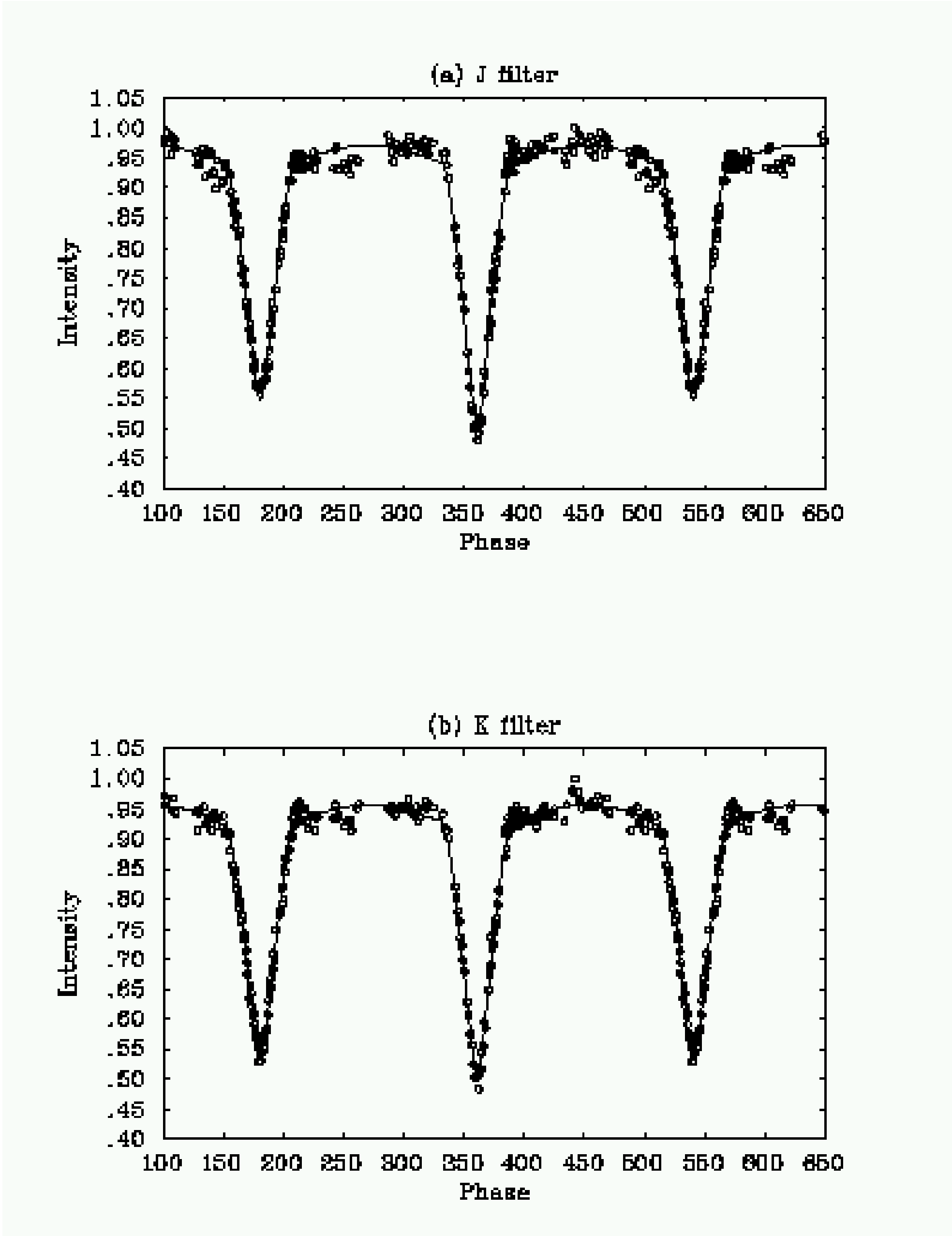

Figure 1. Observed light curves and the fits obtained with *ILOT*. (a) J filter and (b) K filter

Table 2: *ILOT* light curve solutions

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	U filter	B filter	V filter	R filter
L_1	0.649 ± 0.013	0.634 ± 0.008	0.616 ± 0.009	0.600 ± 0.009
L_2	0.307 ± 0.008	0.336 ± 0.004	0.356 ± 0.005	0.374± 0.005
r_1	0.254 ± 0.003	0.255 ± 0.002	0.255 ± 0.003	0.255± 0.003
r_2	0.233 ± 0.003	0.231 ± 0.002	0.233 ± 0.002	0.237± 0.003
k	0.919	0.906	0.914	0.929
i	86°.5± 0.1	86°.5± 0.1	86°.5± 0.1	86°.5± 0.1
χ^2	227	195	257	162
ϵ	0.01	0.01	0.01	0.01
N.Points	199	199	194	198

	I filter	J filter	K filter
L_1	0.586 ± 0.010	0.566 ± 0.008	0.557 ±0.007
L_2	0.386 ± 0.005	0.433 ± 0.002	0.443 ± 0.002
r_1	0.258 ± 0.003	0.255 ± 0.001	0.257± 0.001
r_2	0.241 ± 0.002	0.237 ± 0.001	0.239 ± 0.001
k	0.934	0.929	0.928
i	86°.5± 0.1	86°.7± 0.1	87°.1± 0.1
χ^2	242	520	499
ϵ	0.01	0.01	0.01
N.Points	199	258	256

References:

Abt, H.A., 1965, *PASP*, **77**, 367

Arévalo, M.J, 1994, PhD. thesis Univ. La Laguna

Banks, T. 1993, in Light Curve Modeling of Eclipsing Binary Stars, edited by E.F. Milone (Springer, Berlin) p. 181

Budding, E., & Zeilik, M., 1987, *ApJ*, **319**, 827

Claret, A., Diaz–Cordovés, J., & Giménez, A. 1995, *A&AS*, **114**, 247

Clement, R., Reglero, V., Garcia. M., Fabregat, J. and Suso J. 1997, *A&AS*, **124**, 499

Koch, R.H. 1967, *AJ*, **72**, 411

Popper, D.M. 1997, *AJ*, **114**, 1195

Vicent, A., Piskunov, N.E. and Tuominen, I., 1993, *A&A*, **278**, 523

Xiang, F.Y., Deng, S.F. and Liu, Q.Y. 2000, *A&AS*, **146**, 7

Zeilik, M., Ledlow, M., Rhodes, M. Arévalo, M.J. and Budding, E. 1990, *ApJ*, **354**, 352

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UBV LIGHT CURVES OF AK Her

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The variable star AK Her, an eclipsing binary with a period of 0.42152207 days is the brighter component of the visual double ADS 10408. The fainter component is at the distance of $4\farcs7$ in position angle 322°. The variability of AK Her was discovered by Metcalf (cf: Pickering 1917) and since then it has been the target of photometric and spectroscopic observations by many observers (see Lifang Li et al. 2001). The system shows WUMa-type light curve with obvious O'Connell effect and period variation. AK Her was observed through UBV standard filters at Khadjeh Nassir Addin Observatory of Tabriz University (Iran) during the summer 2001. The phases of the observations were calculated from the elements used by Rovithis et al. (1999):

$$\text{Min I} = \text{HJD} \quad 2422977.254 + 0.42152207 \times E$$

The derived light curves of U, B and V colors are illustrated in Fig. 1. The times of primary and secondary minima were obtained by a parabolic fitting to the profiles of the minima in each filter. Table 1 shows the derived times of minima in Heliocentric Julian Date and also $O-C$ residuals (average of three filters), where $(O-C)_1$ and $(O-C)_2$ values have been calculated according to the ephemeris used by Rovithis et al. (1999) and Lifang Li et al. (2001) respectively. In Table 2 the O'Connell effect ($\text{Max}_\text{I}-\text{Max}_\text{II}$) is given.

Table 1.

Hel. JD	Min-Type	$(O-C)_1$	$(O-C)_2$
2452143.2440	I	0.0349	−0.0308
2452136.2880	II	0.0340	−0.0317

Table 2.

$\text{Max}_\text{I}-\text{Max}_\text{II}$	Filter
0.026	U
0.017	B
0.028	V

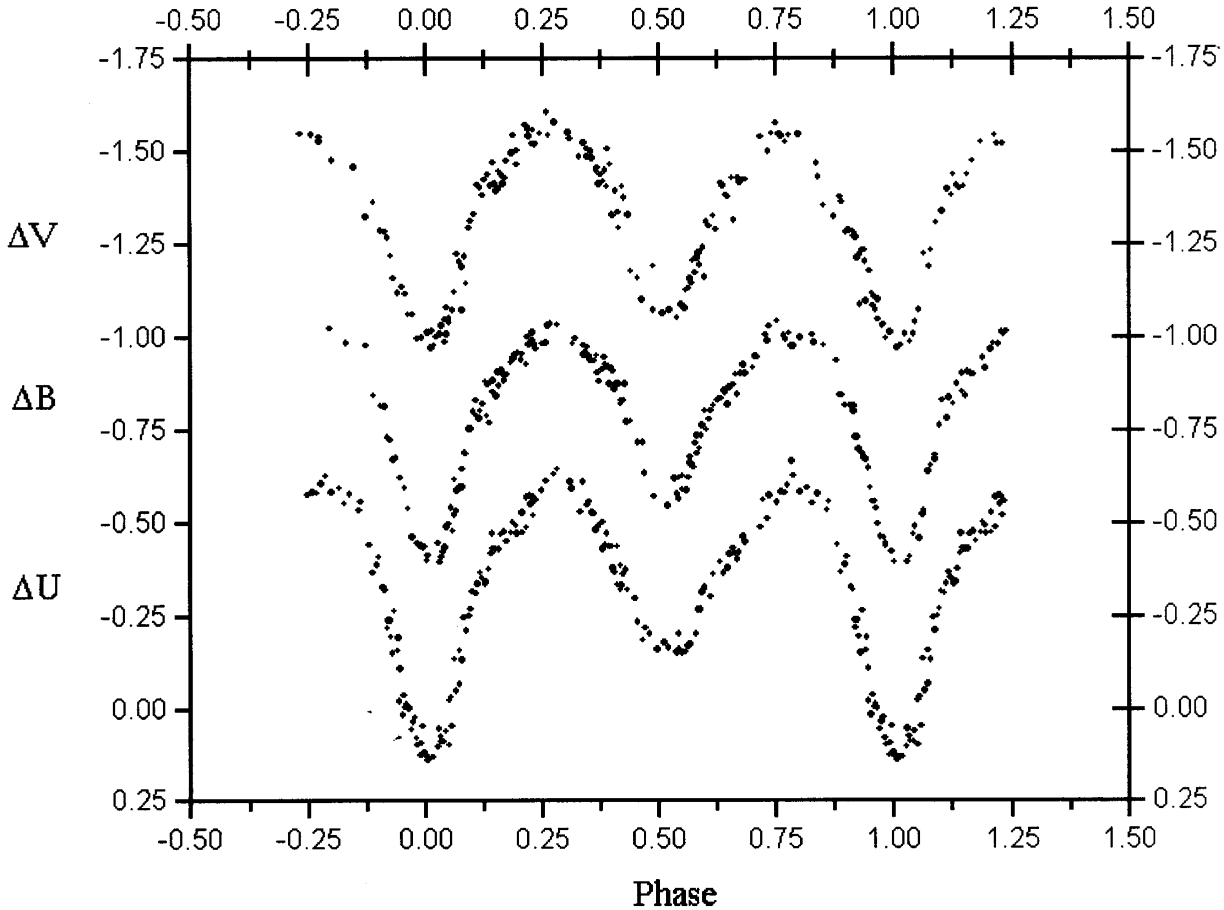

Figure 1.

References:

Lifang Li, Fenghui Zhang, Zhanwen Han, 2001, *A&A*, **368**, 595
Pickering, E. C., 1917, *Harvard Circ.*, **No. 201**
Rovithis-Livaniou, H., Kranidiotis, A., Fragoulopoulou, E., Sergis, N., Rovithis, P., 1999, *IBVS*, 4713

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MINIMA OF BINARY STARS

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Observatory and telescope:
Prince George Astronomical Observatory (PGAO): 61 cm f/12 Cassegrain; Backyard Observatory (BYO): 33 cm f/4.5 Newtonian on Paramount GT-1100s mount

Detector:	PGAO: SBIG ST6 with telecompressor (to f/7), $1''.1 \times 1''.3$ pixels, $5' \times 7'$FOV, cooled to -40 °C BYO: SBIG ST9e with tele-extender (to f/8.9), $1''.4$ pixels, $11'.9 \times 11'.9$ FOV, cooled to -10 °C

Method of data reduction:
Aperture photometry using MIRA, by Axiom Research

Method of minimum determination:
Digital tracing paper method, bisection of chords, curve fitting, and Kwee and van Woerden (1956)

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
CX Aqr	EA/SD	22.3544	−0.4126	G 5233:1831	52136.8117	0.555986	1.
HP Aur	EA	5.10216	35.4748	[not GSC]	51936.3787	1.422819	1.
TY Boo	EW/KW	15.0047	35.0752	G 2568:0991	51957.8764	0.317150	1.
CV Boo	na	15.26192	36.5915	G 2570:0423	51955.9444	0.846994	1.
AE Cas	EA/SD	1.26573	70.0733	G 4301:1549	51947.3320	0.759121	1.
PV Cas	EA/DM	23.10025	59.1206	G 4010:1111	52135.8214	1.750454	1.
V387 Cas	EA/DM	1.00355	58.4157	G 3680:1741	52133.8565	1.608211	1.
XX Cep	EA/SD	23.38199	64.2	G 4288:0150	52136.9064	2.337306	1.
XY Cep	EA/SD	23.535637	68.5823	G 4479:0423	51931.7501	2.774517	1.
GW Cep	EW/KW	1.45591	80.0456	G 4502:0724	51957.9425	0.318844	1.
XZ CMi	EA	7.54065	3.3854	G 0185:1509	51936.8652	0.578807	1.
AK CMi	EA/SD	4.37064	1.4023	G 0187:1081	51913.8210	2.043367	1.
EK Com	EW	12.5121	27.1347	G 1995:2289	51961.0457	0.266686	1.
V859 Cyg	EW/KW	19.27124	28.565	G 2137:0260	49580.3946	0.405004	1.

Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
AF Gem	EA/SD	6.50343	21.2233	G 1343:2551	51922.8889	1.243499	1.
V728 Her	EW/KW	17.1805	41.5041	G 3081:1028	51676.8628	0.471286	1.
WY Hya	EW/KE	8.14112	0.302	G 0195:1434	51964.8064	0.716008	1.
AV Hya	EB/KE	9.35025	5.1911	G 0241:2130	51961.7943	0.683400	1.
DF Hya	EW/KW	8.5223	6.1736	G 0225:0943	51934.9513	0.330597	1.
CN Lac	EB/DW	0.20305	40.1335	G 3605-2646	51812.8787	0.462790	1.
DU Leo	na	9.4411	25.2115	G 2568:0991	52013.6090	0.687093	1.
NS Mon	EW/DW	6.3326	7.5418	G 0733:2002	51933.7458	1.777619	1.
BB Peg	EW/KW	22.22556	16.1959	G 1682:1530	52132.0233	0.361502	1.
BX Peg	EW/KW	21.38532	26.4223	G 2197:1485	51761.9154	0.280417	1.
DV Peg	EW/KE	21.2452	21.1	G 1675:0092	52112.8601	0.949625	1.
DK Peg	EA/DM	23.41335	10.1257	G 1173:1705	52132.8317	1.631827	1.
KL Per	EA/SD	2.41167	48.5618	G 3304:0460	51166.3595	2.223015	1.
Y Psc	EA/SD	23.34253	7.5529	G 1169:0263	52134.9441	3.765759	1.
AU Ser	EW/KW	15.56492	22.154	G 1502:1573	52028.8138	0.386494	1.
AC Tau	EA/SD	4.37064	1.4023	G 0082:0234	51913.8210	2.043367	1.
RV Tri	EA/SD	2.1318	37.0101	G 2321:0244	52116.8846	0.753666	1.
AX Vir	EB/KE	13.2745	3.5228	G 0303:0193	51964.9697	0.702526	1.
G1534:0753	na	17.025047	21.3959	G 1534:1027	52015.0936	0.511158	1.
G1991:1390	na	12.32049	26.2248	G 1991:1447	51992.8346	0.286362	1.
G1991:1390	na	12.32049	26.2248	G 1991:1447	51992.8346	0.286362	1.
G2035:0175	na	16.0154	24.5216	G 2035:0109	51750.7083	0.268730	1.
G2035:0175	na	16.0154	24.5216	G 2035:0109	51750.7083	0.268730	1.
G2038:0674	na	16.1005	25.3655	G 2038:0040	51989.9672	0.530831	1.
G2530:2276	na	12.3201	35.29597	G 2530:2154	51991.9728	0.305967	1.
G2532:0514	na	13.00117	30.231	G 2532:0946	52010.7820	0.301988	1.
G2532:0514	na	13.00117	30.231	G 2532:0946	52010.7820	0.301988	1.
G2533:1519	na	12.4033	34.2256	G 2533:1553	51998.7445	0.491419	1.
G2533:1563	na	12.4441	35.5756	G 2533:0959	51956.0078	0.329068	1.
G3021:2642	na	12.4337	38.4415	G 3021:2615	51955.7666	0.326894	1.
G3021:2642	na	12.4337	38.4415	G 3021:2613	51955.7666	0.326894	1.
G3026:1046	na	13.3726	37.3458	G 3026:0922	52001.9066	0.349189	1.
G3092:1291	na	17.4411	40.1655	G 3092:1157	52024.9883	0.346925	1.
G3103:0919	na	18.1521	39.0545	G 3103:0849	52064.8900	1.238813	1.
G3112:0179	na	18.2138	42.1008	G 3112:1051	52054.8478	0.995959	1.

Notes: RA values are in the format HH.MMSS, Dec in DD.MMSS. G stands for GSC.

Source(s) of the ephemeris:
1. This paper (see remarks).

Explanation of the remarks in the table:
* Note: The comparison for HP Aur is located approximately 1° north of the variable.

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
CX Aqr	52136.8123	0.0002	I	none		BYO
HP Aur *	51935.6673	0.0001	II	none		PGAO
TY Boo	51957.8764	0.0001	I	none		PGAO
CV Boo	51955.9444	0.0001	I	none		PGAO
AE Cas	51913.9283	0.0001	I	none		PGAO
AE Cas	51946.9520	0.001	II	none		PGAO
PV Cas	52135.8214	0.0001	I	none		BYO
V387 Cas	52133.8565	0.0004	I	none		BYO
XX Cep	52136.9064	0.0004	I	none		BYO
XY Cep	51931.7501	0.0005	I	none		PGAO
GW Cep	51935.7847	0.0001	II	none		PGAO
GW Cep	51957.7830	0.0001	II	none		PGAO
XZ CMi	51936.8652	0.0002	I	none		PGAO
AK CMi	51934.7501	0.0003	I	none		PGAO
EK Com	51960.9124	0.0002	II	none		PGAO
V859 Cyg	52134.7548	0.0001	I	none		BYO
AF Gem	51922.8889	0.0002	I	none		PGAO
V728 Her	51983.9129	0.0002	II	none		BYO
WY Hya	51916.8334	0.0001	I	none		PGAO
WY Hya	51964.8064	0.0002	I	none		PGAO
AV Hya	51961.7943	0.0002	I	none		PGAO
DF Hya	51934.9513	0.0001	II	none		PGAO
CN Lac	52093.8300	0.001	I	none		BYO
DU Leo	51957.9543	0.0002	II	none		PGAO
NS Mon	51933.7458	0.0002	I	none		PGAO
BB Peg	52131.8425	0.0002	II	none		BYO
BX Peg	52015.9750	0.0001	I	none		BYO
DV Peg	52112.8601	0.0002	II	none		BYO
DK Peg	52132.8317	0.0001	I	none		BYO
KL Per	52137.8501	0.0007	I	none		BYO
Y Psc	52134.9441	0.0002	I	none		BYO
AU Ser	52028.8139	0.0001	I	none		BYO
AC Tau	51913.8210	0.0001	I	none		PGAO
RV Tri	52116.8845	0.0001	I	none		BYO
AX Vir	51964.9697	0.0002	I	none		PGAO
G1534:0753	52014.8379	0.0001	II	none		BYO
G1991:1390	51992.8346	0.0001	I	none		PGAO
G1991:1390	51962.9098	0.0001	II	none		PGAO
G2035:0175	52019.8715	0.0001	I	none		BYO
G2035:0175	52038.8169	0.0001	II	none		BYO
G2038:0674	51989.8345	0.0001	II?	none		BYO
G2530:2276	51991.8204	0.0002	II	none		BYO
G2532:0514	52010.7820	0.0002	I	none		BYO
G2532:0514	52000.8160	0.0001	I	none		BYO
G2533:1519	51998.7440	0.0002	I	none		BYO
G2533:1563	51955.8433	0.0003	II?	none		PGAO

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
G3021:2642	51955.7666	0.0002	II	none		PGAO
G3021:2642	52014.7711	0.0002	I	none		BYO
G3026:1046	52001.7327	0.0002	I	none		BYO
G3092:1291	52024.8148	0.0001	I	none		BYO
G3103:0919	52064.8900	0.01	I	none		BYO
G3112:0179	52054.8499	0.0007	I	none		BYO

Remarks:

A problem emerged for the BYO data during the routine photometry of the check stars, performed some time after the original data were taken and reduced. It was discovered that nightly drifts of a few hundreds of a magnitude occurred for the check stars in some (but not all) data sets. The causes of this drift are presently unknown (flatfielding was scrupulously done in all cases) but are thought to arise from possible misalignments of the tele-extender lens axis with that of the main optical axis, focussing errors, possibly inadequate tube baffling, stray lights, etc. Clearly this situation is unacceptable and will be dealt with before more data are taken. However, to correct the existing BYO data, linear fits by least-squares were made of the check star magnitudes versus time and linear corrections (extrapolated to the location of the variable where possible) were applied to the variable star magnitudes versus time. The times of minima were then redetermined and the differences from the uncorrected ToMs noted. These differences, or corrections, ranged from 0.00008 to 0.01 days; the median was 0.0004 days. Rather than discard some of the obviously less accurate times of minima, since many are for ROTSE stars (Akerlof, C., et al., 2000) which have not been previously observed, it was decided to report all the values with estimated errors equal to the internally estimated errors or the corrections themselves, whichever was larger. These are given in Table 2. Information on period behaviour for most of the stars listed in Table 1 is available in a website, the URL for which is given in the references. The ephemerides were calculated with the help of O−C charts using all available published times of minima.

Acknowledgements:

Thanks are due to Environment Canada for the website satellite views (see reference below) that were essential in predicting clear times for observing runs in this cloudy locale. The author is also a Guest User of the Canadian Astronomy Data Centre, which is operated by the Dominion Astrophysical Observatory for the National Research Council of Canada's Herzberg Institute of Astrophysics.

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HadV67 = V648 Oph, A REMARKABLY REGULAR MIRA

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In 1925, F. Ross suspected variability of the star located at $18^h32^m06^s$, $+08°06\overset{m}{.}9$ (1875), later designated Ross 51 (Ross, 1926). No finding chart was published. Ten years later, Hoffmeister (1936) discovered a Mira variable in the field of Ross 51 and decided it was a rediscovery of Ross 51. As usual for his rediscoveries, Hoffmeister did not present a finding chart either. Ahnert (1942) studied Hoffmeister's star, gave improved variability range ($12\overset{m}{.}5$–$<17^m$) and the star's light elements (Max $= 2425665 + 168\overset{d}{.}7 \cdot E$). His paper also does not give a finding chart. Until recently, we were not aware of any other studies of this star, known as V648 Oph in the system of GCVS names, and the star's accurate position remained unknown.

In 2000, K. Haseda (Aichi, Japan) discovered the variable HadV67. This discovery was announced by Kato (2000) who remarked that the star's position was close to that of V648 Oph. The star can be identified with IRAS 18358+0810. Its coordinates in the USNO A2.0 catalog (Monet *et al.*, 1998) are $18^h38^m17\overset{s}{.}59$, $+08°13'22\overset{''}{.}7$ (2000.0), and its brightness and color are $b = 16\overset{m}{.}0$, $b - r = 2\overset{m}{.}5$. From a limited number of observations of 1997–2000, with four brightenings, the star was considered a possible Mira with variations within $11\overset{m}{.}2 - < 13\overset{m}{.}9\ V$. Greaves (2000) noted that bright estimates of HadV67 during the above time interval agreed with the GCVS period value for V648 Oph (169^d).

We attempted to prove or reject the identification of HadV67 with V648 Oph on the base of our estimates of HadV67 on 114 plates of the 40 cm astrograph of the Sternberg Institute's Crimean Laboratory (JD 2445198–2447749). The estimates were made by E.N.P. The magnitude scale of the comparison stars relies on blue magnitudes of the USNO A2.0 catalog.

Figure 1 presents a $5' \times 5'$ finding chart for HadV67 based upon the blue image of the second POSS. The cross is the nominal position of Ross 51. HadV67 is obviously strongly variable and red, judging from POSS I and POSS II images available at the Digitized Sky Survey and at the USNO Image and Catalogue Archive. Along with HadV67, we also estimated the star GSC 1024.3127, situated in $0\overset{'}{.}5$ to the north-west of the nominal position of Ross 51 and having, in the USNO A2.0 catalog, $b = 14\overset{m}{.}2$, $b - r = 2\overset{m}{.}2$. This star ("GSC" in Fig. 1) was found constant for the whole time interval of our observations.

Our estimates confirm Mira-type variability of HadV67 within $13\overset{m}{.}3 - 17\overset{m}{.}1\ B_{pg}$. The star's light elements are Max $= 2447059 + 168\overset{d}{.}76 \cdot E$. The light curve with these elements is presented in Fig. 2. It is remarkably regular for a Mira. The four brightenings from Kato (2000) are in a good agreement with our light elements, whereas the old epoch of maximum from Ahnert (1942) gives $O - C = +39^d$.

The period we find is very close to the value from Ahnert (1942), thus we conclude that HadV67 is identical with V648 Oph.

Thanks are due to S.V. Antipin and N.N. Samus for their attention and assistance. Our variable star studies are supported, in part, by grants from the Russian Foundation for Basic Research and from the Council of the Program of Support for Leading Scientific Schools of Russia. We used the Digitized Sky Survey images provided by the Hubble Space Telescope Science Institute under support from grant NAG-W2166 of the USA Government and images provided by the US Naval Observatory Image and Catalogue Archive.

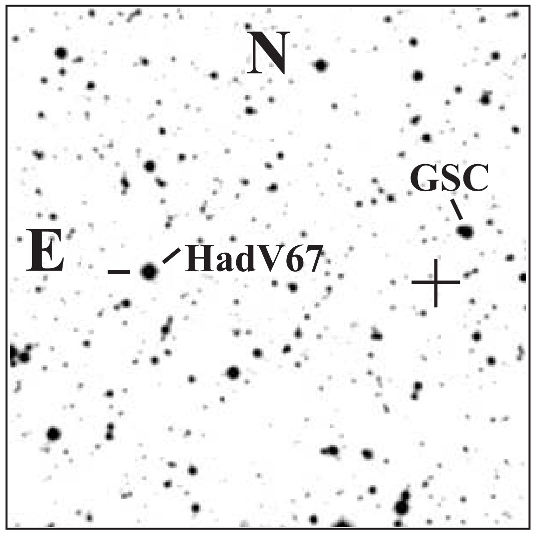

Figure 1. The finding chart of HadV67 = V648 Oph (5′ × 5′). The cross is the nominal position of Ross 51. "GSC" is GSC 1024.3127.

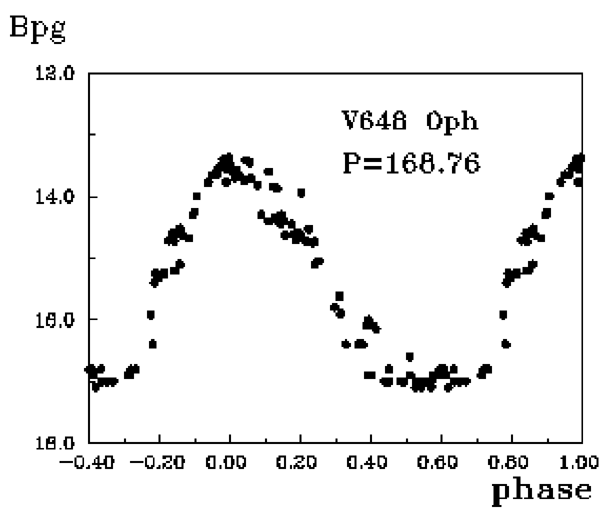

Figure 2. The light curve of HadV67 = V648 Oph.

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DISCOVERY OF THE CV ROTSE3 J015118.59–022300.1

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On October 11, 2001, the first ROTSE-III automated telescope began observations in Los Alamos, NM, USA. ROTSE-IIIa is an 0.45 m telescope with a 1.85 degree field-of-view, carrying an unfiltered, thinned CCD. Although the primary task of this telescope is to rapidly respond to satellite detections of Gamma-Ray Bursts, most of the observing time is used to perform automated sky patrols. Pairs of images are taken for each of ~ 100 patrol fields twice a night.

Analysis of the first ROTSE-IIIa dark run has uncovered an interesting transient event, which we identify as a nova and designate ROTSE3 J015118.59–022300.1. This object is absent in images taken on October 11, 2001, to limiting aperture magnitudes of $m_{\rm ROTSE3} \sim 17\overset{\rm m}{.}9$. It is also absent from skyview images, scanned SERC plates from the USNO PMM archive, and the USNO A2.0 catalog. On October 13, 2001, however, the object appears at $m_{\rm ROTSE3} = 14\overset{\rm m}{.}00 \pm 0\overset{\rm m}{.}06$ (weather conditions prohibited observations on Oct 12), after which it fades rapidly, falling by more than 2 magnitudes over the next 13 d (Fig. 1). Assuming an onset time of 1.0 d before the first detection, the best-fit decay index for the light curve is $\alpha \sim 0.9$ ($m \propto t^{-\alpha}$), although even the early light curve in Figure 1 is clearly inconsistent with a single power law.

On 2001 Nov 20.129 and Dec 14.235 the source was observed at BVR_cI_c using the USNO, Flagstaff Station 1.0m telescope with a SITe/Tektronix 1024×1024 CCD camera (Henden 2001). Figure 2 shows the V-band image from the Nov 20 dataset. The nova was found to be at $V = 20\overset{\rm m}{.}70 \pm 0\overset{\rm m}{.}07$ and $20\overset{\rm m}{.}90 \pm 0\overset{\rm m}{.}05$ in the two observations, respectively, indicating the system may have returned to its quiescent state. This brightness, however, is still well above the POSS-II blue plate limit; there may still be some residual activity from the disc, and the quiescent spectrum may be extremely red. The four-color photometry for these two observations is reported in Table 1. The USNO images along with USNO-A2.0 provide the following coordinates for the object: R.A.$=01^{\rm h}51^{\rm m}18\overset{\rm s}{.}60 \pm 0.01$ and Decl.$= -2^\circ 23' 0\overset{\prime\prime}{.}42 \pm 0.09$ (J2000.0). The ROTSE-IIIa position is consistent with this location to within its errors ($0\overset{\rm s}{.}06$ R.A., $0\overset{\prime\prime}{.}8$ Decl.). The ROTSE astrometric accuracy has been calibrated against the USNO A2.0 catalog (Smith et al. 2002).

We used the first V-band image to set a photometric zero-point for the unfiltered ROTSE-III images and estimate the V magnitude for the source. Using 46 bright stars ($m_{\rm ROTSE3} < 16^{\rm m}$) that show no evidence for variations in intensity ($\sigma_m < 0.2$ mag) during the 56 ROTSE-III observations, we found the median offset between the ROTSE aperture magnitudes and the USNO V-band magnitudes to be $V - m_{\rm ROTSE3} = +0\overset{\rm m}{.}71$. The offset for any given object is of course dependent on its spectral energy distribution, and we show the offset as a function of color for three different colors in Figure 3. Since the spectrum of the nova during the outburst is unknown, this necessarily introduces undetermined systematic errors into the magnitude estimates.

Figure 1 shows as diamonds the ROTSE V-magnitude estimates for ROTSE3 $J015118.59-022300.1$. Also plotted as triangles, late in the light curve, are the USNO V-band measurements. Arrows indicate the mean limiting magnitude for a pair of ROTSE images in which the nova was not detected. Error bars on the ROTSE magnitudes include an estimate of the known systematic errors (as measured through our relative photometry procedure) added in quadrature to the statistical uncertainty.

At time 02:32:41 (UT) on Nov 11, 2001, a spectrum of the source was recorded in a 20-minute exposure with the Boller and Chivens Spectrograph on the 6.5 m Walter Baade Magellan project telescope (Fig. 4). The spectrum shows a continuum with broad but relatively weak Balmer emission lines: H_γ, H_δ, H_ϵ and H_8. The lines are about 3000 km s^{-1} wide and have a "square" profile (steep sides and flat top), characteristic of accretion disc systems. The intensity of the line emission is about half that of the continuum. The radial velocity is less than a few hundred km s^{-1}.

We therefore identify ROTSE3 J015118.59–022300.1 as a galactic cataclysmic variable. While the high galactic latitude ($b = -40\overset{\circ}{.}74$) of this object is unusual, it is not unprecedented (Downes, Webbink & Shara 1997). If we classify this event as a fast nova, the scaling relations in Duerbeck (1981) would predict a peak absolute magnitude around V$\sim -8\overset{\rm m}{.}5$. An extrapolation of the decaying light curve predicts a peak apparent maximum of V$\sim 14\overset{\rm m}{.}5$ at one day before the first detection, which implies a distance modulus (DM) of $\sim$ 23, or 420 kpc. If our conversion to V-band overestimates V, the resulting distance could be as low as 320 kpc. At this latitude, extinction cannot explain this unreasonably large distance. If it is a fast nova, it is an unusually dim one. With the large increase in brightness, it is unlikely that the source is a dwarf nova (Osaki 1996). Also, its absence in the plates scanned by the USNO PMM machine (12 epochs from 1953-1997) requires a low duty cycle. If this is a dwarf nova, it may be akin to WZ Sge. It may be a recurrent nova: a diverse class known to recur on timescales of decades (Cordova 1994). Further observations are necessary to reliably classify this system.

ROTSE is supported by NASA under SR&T grant NAG5-5101, the NSF under grant AST 99-70818 and fellowship 00-136, the UofM, and the Michigan Space Grant Consortium. Work by LANL is supported by the DoE under contract W-7405-ENG-36.

Table 1. The USNO Four-Color Intensity Measurements for ROTSE3 J015118.59–022300.1

UTD	B	V	R_C	I_C
011121.129	20.74 ± 0.05	20.70 ± 0.07	20.25 ± 0.06	19.80 ± 0.08
011214.235	20.91 ± 0.03	20.90 ± 0.05	20.76 ± 0.07	20.29 ± 0.10

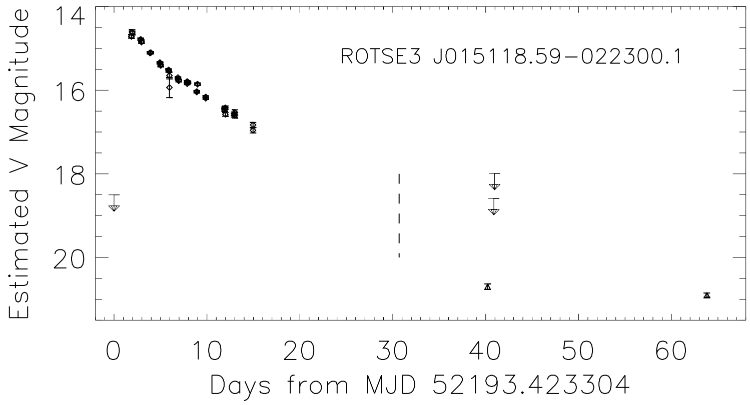

Figure 1. Light curve for a transient nova discovered by ROTSE-IIIa. The ROTSE-IIIa unfiltered magnitudes have been corrected by $+0\overset{\mathrm{m}}{.}71$ to estimate the source's V-band magnitude. Arrows indicate the mean limiting magnitudes of pairs of images in which the source was not detected. V-band observations with the USNO Flagstaff Station 1.0m telescope are indicated by the triangles at 40 and 64 days. The vertical dashed line indicates when a spectrum of the source was taken with Magellan.

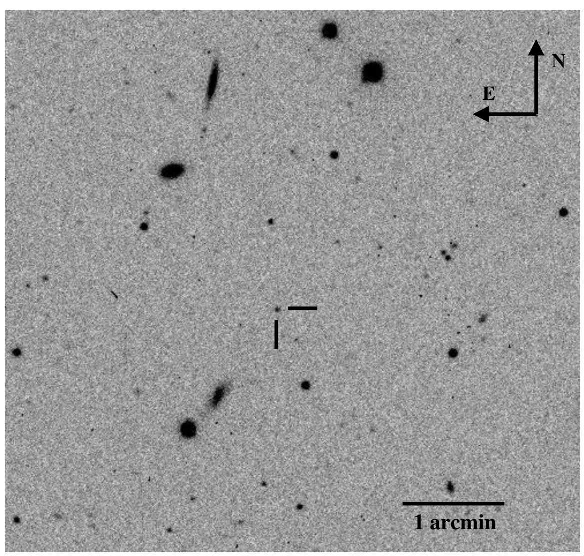

Figure 2. Image of the region around ROTSE3 J015118.59–022300.1, from the USNO Flagstaff Station 1.0m telescope at 2001 Nov 20.129 (UTC). The nova, at $V = 20\overset{\mathrm{m}}{.}70 \pm 0.07$, is indicated by crosshairs.

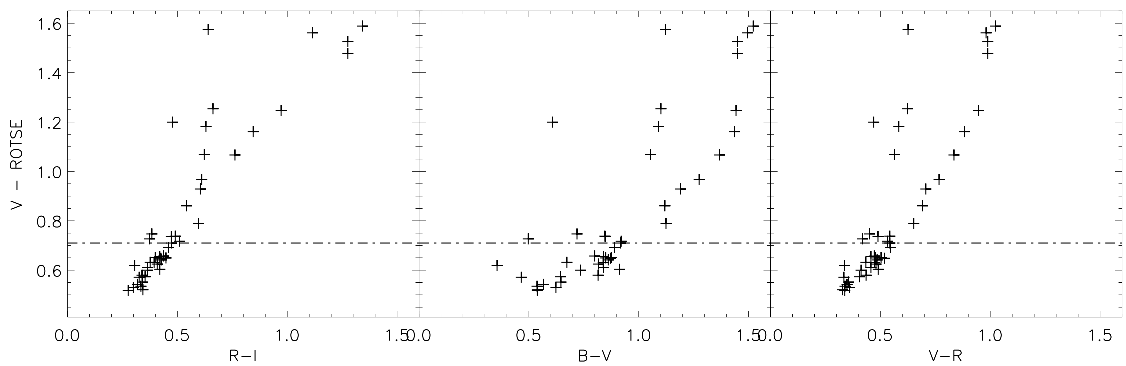

Figure 3. Offset between ROTSE magnitude and V magnitude versus the BVR_CI_C colors for 46 template stars of constant intensity. The broken line indicates the median value of this offset.

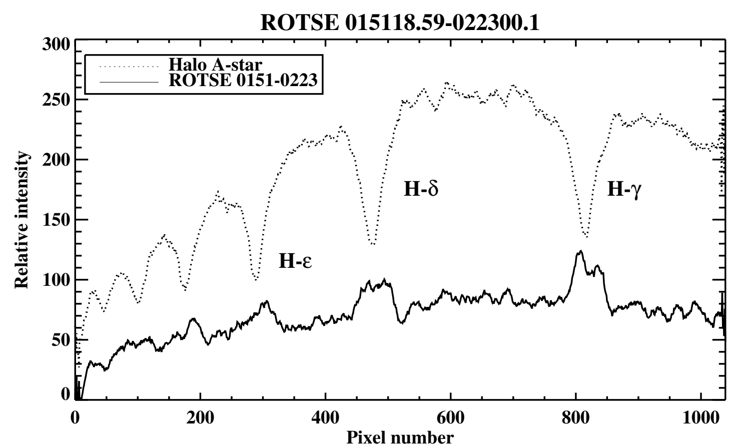

Figure 4. Spectrum of ROTSE3 J015118.59–022300.1, as compared with a nearby halo A-star, from a 20-minute exposure with the Boller and Chivens Spectrograph on the 6.5 m Walter Baade Magellan project telescope at 2001 Nov 11.1060 (UTC).

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RADIAL VELOCITIES AND ORBITAL SOLUTION OF THE ACTIVE BINARY STAR FG URSAE MAJORIS

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FG Ursae Majoris (HD 89546) is an active single-lined binary, whose spectral type is approximately G8 IV (Henry et al. 1995). Although its relatively high luminosity ($V = 7\overset{m}{.}4$, amplitude of the variability = 0.04−0.15 mag, Henry et al. 1995), FG UMa is a poorly studied binary. Together with photospheric variability, the star shows typical signatures of strong chromospheric activity. Montes et al. (2000) reported on filled-in Hα and Hβ lines and strong Ca II H & K emission with self-absorption. Similar features were found by Strassmeier et al. (2000). Hα variability is reported in the CABS (Strassmeier et al. 1993) and by Henry et al. (1995). No radial velocity and orbital solution of FG UMa has been published till now.

Spectroscopic observations were obtained at *M. G. Fracastoro* station of Catania Astrophysical Observatory in 1997, 1999 and 2000 with the 91-cm telescope, using the REOSC echelle spectrograph in the cross-dispersion configuration. This mode yields a resolution of $\lambda/\Delta\lambda \simeq 14000$. The spectrograph is fed by the telescope through an optical fiber (UV-NIR, 200μm core diameter) and is placed in a stable position on the first floor of the telescope building. The detector used during the 1997 observations was an 800×1152 CCD with a pixel size of 22.4 μm. For the 1999 and 2000 observations a back-illuminated 1024×1024 CCD, with a pixel size of 24 μm, was used. Signal-to-noise ratio from 100 to 250, depending on atmospheric conditions, was reached.

Data reduction was performed using the ECHELLE task of the IRAF package. The data were bias-subtracted and then flat-field corrected using halogen lamp spectra. The wavelength calibration is based on a thorium-argon comparison lamp.

Radial velocities were obtained by cross-correlation of each order of FG UMa spectra with the corresponding order of the radial-velocity standard stars α Arietis, Arcturus, Aldebaran and 5 Serpentis, used as templates. The radial velocity values of the standard stars were taken from Evans (1967) and Duflot et al. (1995).

Spectral regions heavily affected by telluric lines (such as the λ 6276−6315 series of O_2) were excluded from the cross-correlation.

The radial velocity measurements are weighted means of the individual values deduced from each order. Each of these individual values was weighed as $W_i = \frac{1}{\sigma_i^2}$. The standard errors of the weighed means were computed according to the usual formula (see e.g. Topping 1972) on the basis of σ_i errors in the RV values for each order. The latter are computed according to the fitted peak height and the anti-symmetric noise as described by Tonry & Davis (1979).

The orbital period was determined by applying the periodogram technique (Scargle 1982). The CLEAN iterative deconvolution algorithm (Roberts et al. 1986) was used to eliminate the effect of the observation spectral window in the power spectrum. The maximum of the power spectrum yields a period of P_{orb} = 21.3675 days, in agreement with the orbital period of 21.3 days and the photometric period of 21.5 ± 0.3 days given by Henry et al. (1995).

The observational points and the best-fit sinusoidal solution (eccentricity equal to 0) are plotted in Figure 1. Error bars, when larger than data points, are also displayed.

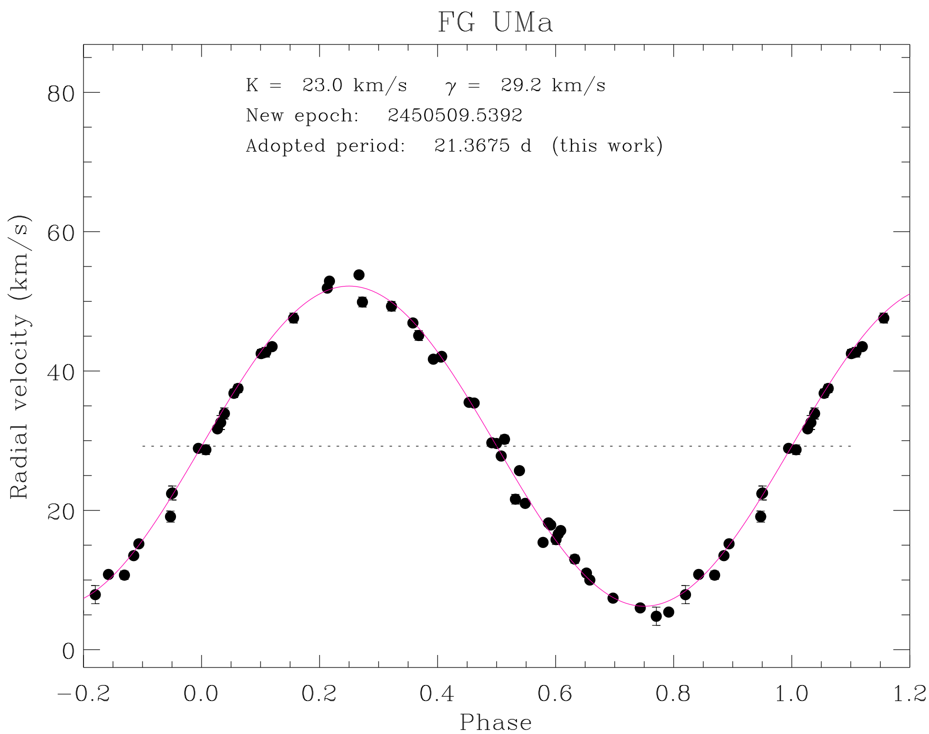

Figure 1. Radial velocity curve and best-fit solution of FG UMa

Table 1 lists the orbital and physical parameters derived from our circular solution.

The low value of the mass function does suggest a low-mass secondary or a low-inclination orbit. The latter hypothesis is consistent with the absence of eclipses in the light curve (Henry et al. 1995).

Let us make some considerations about the spectral types and masses of FG UMa components.

Table1. Orbital parameters for the primary component of FG UMa.

Element	Present solution
K_1	22.97 ± 0.08 (km s^{-1})
γ_1	29.21 ± 0.06 (km s^{-1})
$T_{\rm conj}$	2450509.539 ± 0.010 (JD)
P	21.3675 ± 0.0100 (day)
$a_1 \sin i$	$(6.75 \pm 0.02) \times 10^6$ km
$f(m)_1$	0.02685 ± 0.00039 (M$_\odot$)

Unpublished photometric observations obtained at Catania Observatory by A. Frasca in March-April, 2000, yield a V magnitude ranging from $7\overset{\rm m}{.}26$ to $7\overset{\rm m}{.}37$, and a $B-V$ colour going from 0.97 to 1.01 mag. The V magnitude and $B-V$ colour index reported in the *Hipparcos Catalogue* (ESA 1997) are 7.39 and 1.004 mag, respectively. Henry et al. (1995) give $V = 7.452$ mag.

With a distance of 175 ± 25 pc (ESA 1997) we estimate an average absolute magnitude $M_{\rm V} = 1.0 \pm 0.3$ mag which is typical of a giant star, well above the subgiant branch. The $B-V$ colour is consistent with a spectral type classification G9−K0 III, for which a radius of 10−15 R$_\odot$ is expected (Gray 1992, Schmidt-Kaler 1982). The $v \sin i = 18$ km s^{-1} given by Fekel (1997) leads to a minimum radius of $R_1 \sin i = 7.6$ R$_\odot$. So, an inclination of the rotation axis of about 30°−50°can be estimated. For a star of such an evolutionary stage, a mass of about 2.3−2.9 M$_\odot$ can be inferred (see e.g. Straizys & Kuriliene 1981, Gray 1992).

We have also noted that the spectrum of the inactive K0 III-type star 34 Lyn (Upgren & Staron 1970), broadened to $v \sin i = 18$ km s^{-1}, perfectly reproduces the FG UMa photospheric spectrum, while the G8 IV inactive star 31 Aql leads to a poor comparison with the FG UMa spectrum.

A rough guess of the secondary-star mass can be achieved through the mass function derived from our radial velocity curve. Assuming an inclination of 50°and a primary-star mass $M_1 = 2.3 - 2.9\,M_\odot$, we find a mass $M_2 = 0.9 - 1.1\,M_\odot$, for the secondary star. In agreement with the evolutionary times of such two components, the latter star may be still on the main sequence. Its spectral type should be between G0 V and G8 V and, consequently, its absolute magnitude should be in the 4.5−5.5 mag range. This implies a magnitude difference of about 3.5−4.5 mag between the primary and secondary component, i.e. the secondary would contribute only 2−5 % of the total flux at red wavelengths.

This combination of spectral types and magnitudes can explain why only the primary component is visible in our spectra. High-resolution spectroscopy with very high signal-to-noise ratio in the blue-UV region could show the contribution of the secondary component to the spectrum.

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ECLIPSING VARIABLE GSC 2084.0777 = ROTSE1 J174103.55+273429.1

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The wealth of data gathered by the ROTSE1 CCD Survey (Akerlof et al., 2000) has resulted in the discovery of a large number of previously unknown variable stars, many of which are eclipsing binaries. In a continuing cooperative effort, the variability of GSC 2084.0777 = ROTSE1 J174103.55+273429.1 has been studied by a team of AAVSO members. All sky photometry was performed in order to determine the color indices for the variable and comparison stars. We used CCD and photographic observations to accurately determine the light elements of the system. In this note we discuss our methods of observation and present an ephemeris and light curve.

From his private observatory Lubcke observed the system with a 0.28-m Schmidt-Cassegrain telescope equipped with a ST9E CCD. On 12 nights, from JD2451775 to JD2452120. A total of 362 observations were made, yielding four primary and two secondary times of minimum. Nelson observed GSC2084.0777 from the observatory of the Prince George Astronomical Society using a 0.60-m Cassegrain telescope and a ST6 CCD camera. From these unfiltered observations three times of primary minimum and four times of secondary minimum were extracted.

Henden used the USNO Flagstaff Station 1.0-m. telescope equipped with a SITe/Tektronix 1024 × 1024 CCD to observe the field in the standard Johnson-Cousins BVR_cI_c passbands on five photometric nights, using Landoldt standards to calibrate the field. Astrometry is based on USNO-A 2.0 and has errors less than 100mas internal error. With magnitude and color errors shown in parenthesis to the last decimal place, the variable, comparison and check stars were standardized as follows:

Star	GSC	RA (J2000)	DEC	V	$B-V$	$V-R_c$	R_c-I_c
var [1]	2084.0777	17:41:03.354	+27:34:34.77	11.887(2)	0.617(1)	0.361(2)	0.338(2)
var [2]	2084.0777	17:41:03.354	+27:34:34.77	12.374(3)	0.630(3)	0.366(4)	0.350(5)
comp	2084.1119	17:41:29.097	+27:37:06.70	12.594(2)	0.476(18)	0.283(11)	0.293(12)
check	2084.1154	17:41:31.324	+27:31:39.99	12.472(24)	0.766(15)	0.410(12)	0.366(11)

1 = maximum light, 2 = primary minimum.

More complete photometric information about all stars within 5 arcmin of the variable can be found in 5228-t2.txt. In addition, Henden recorded a time of primary minimum in V which appears in Table 1.

Guilbault visited the Harvard College Observatory and estimated the brightness of GSC 2084.0777 on 165 blue- sensitive photographic plates from the AC, Damon and RH Patrol Series. From these observations 24 times of minimum light were gathered. The times of minimum light from all sources are collected in Table 1.

Table 1. Times of minimum, GSC 2084.0777

HJD 2400000 +	Type	Error +/−	Cycle	$O-C$ (d)	Phase	Observer	Source
25369.845	I	-	−66420	−0.006	0.986	Guilbault	pg
28012.605	I	-	−59777	−0.021	0.947	Guilbault	pg
28716.761	I	-	−58007	−0.022	0.945	Guilbault	pg
29816.642	II	-	−55242	+0.062	0.656	Guilbault	pg
42219.718	II	-	−24065	+0.035	0.587	Guilbault	pg
42325.513	II	-	−23780	+0.008	0.518	Guilbault	pg
42574.753	I	-	−23173	+0.008	0.019	Guilbault	pg
42684.517	I	-	−22897	−0.029	0.925	Guilbault	pg
42844.897	I	-	−22494	+0.026	0.065	Guilbault	pg
44369.735	I	-	−18658	−0.013	0.967	Guilbault	pg
44425.642	II	-	−18541	−0.001	0.497	Guilbault	pg
44465.648	I	-	−18420	+0.023	0.058	Guilbault	pg
44732.762	II	-	−17749	−0.005	0.488	Guilbault	pg
44782.680	I	-	−17623	−0.014	0.964	Guilbault	pg
44836.609	II	-	−17487	+0.009	0.523	Guilbault	pg
45053.830	II	-	−16941	−0.016	0.523	Guilbault	pg
45260.491	I	-	−16422	+0.005	0.011	Guilbault	pg
45823.795	I	-	−15006	+0.017	0.958	Guilbault	pg
46146.862	I	-	−14194	+0.013	0.034	Guilbault	pg
46562.780	II	-	−13149	+0.002	0.504	Guilbault	pg
46652.684	II	-	−12923	−0.004	0.491	Guilbault	pg
47243.875	II	-	−11436	+0.014	0.535	Guilbault	pg
47294.801	II	-	−11308	+0.018	0.545	Guilbault	pg
47628.755	I	-	−10469	−0.005	0.987	Guilbault	pg
51781.6929	I	0.0001	−30	+0.000	0.999	Lubcke	CCD unfiltered
51784.6766	II	0.0001	−23	+0.000	0.499	Lubcke	CCD unfiltered
51792.6334	II	0.0001	−3	+0.000	0.499	Lubcke	CCD unfiltered
51793.6282	I	0.0001	0	+0.000	0.000	Lubcke	CCD unfiltered
51803.5742	I	0.0004	+25	+0.000	0.001	Lubcke	CCD unfiltered
51809.7395	II	0.0006	+40	−0.001	0.498	Nelson	CCD unfiltered
52000.8971	I	0.0001	+521	−0.000	0.000	Nelson	CCD unfiltered
52020.7876	I	0.0002	+571	−0.001	0.998	Nelson	CCD unfiltered
52038.8897	II	0.0001	+617	+0.001	0.500	Nelson	CCD unfiltered
52047.8403	I	0.0001	+639	+0.000	0.999	Nelson	CCD unfiltered
52054.8020	II	0.0001	+656	+0.000	0.498	Nelson	CCD unfiltered
52073.8980	II	0.0003	+704	+0.000	0.499	Nelson	CCD unfiltered
52110.6974	I	0.0000	+797	+0.000	0.999	Henden	CCD V-filter
52120.6434	I	0.0001	+822	+0.000	0.000	Lubcke	CCD V-filter

The CCD times of minimum were determined using the computer program AVE (Barbera, 2000) based on the Kwee–Van Woerden (1956) method. These photometric times of primary minima were fitted into a least squares solution to yield the preliminary light elements $HJD_I = 2451793.6282(0) + 0\overset{d}{.}39782832(10) \times E$. The archival minima gathered at Harvard have enabled us to more accurately refine the period of GSC 2084.0777. In most cases the photographic exposures were of 60 minutes duration and the time of mid-exposure is the date the variable was estimated to be at minimum light. The earliest primary minima have been excluded from our solution. The Harvard primary minima from 2442574 to 2447628 were assigned a weight of 1 and the CCD primary minima a weight of 10. Our analysis determined the following ephemeris:

$$\begin{array}{rl} \text{Min. I} = \text{HJD } 2451793.6280 + 0\overset{d}{.}39782863 \times E. \\ \pm 0.0006 \pm 0.00000010 \end{array}$$

The unfiltered CCD observations by Lubcke were folded using the elements above and the phased light curve is shown in Figure 1, and these data are available electronically as 5228-t3.txt through the *IBVS* Web site. The magnitudes shown are differential magnitudes with respect to the comparison star GSC 2084.1119.

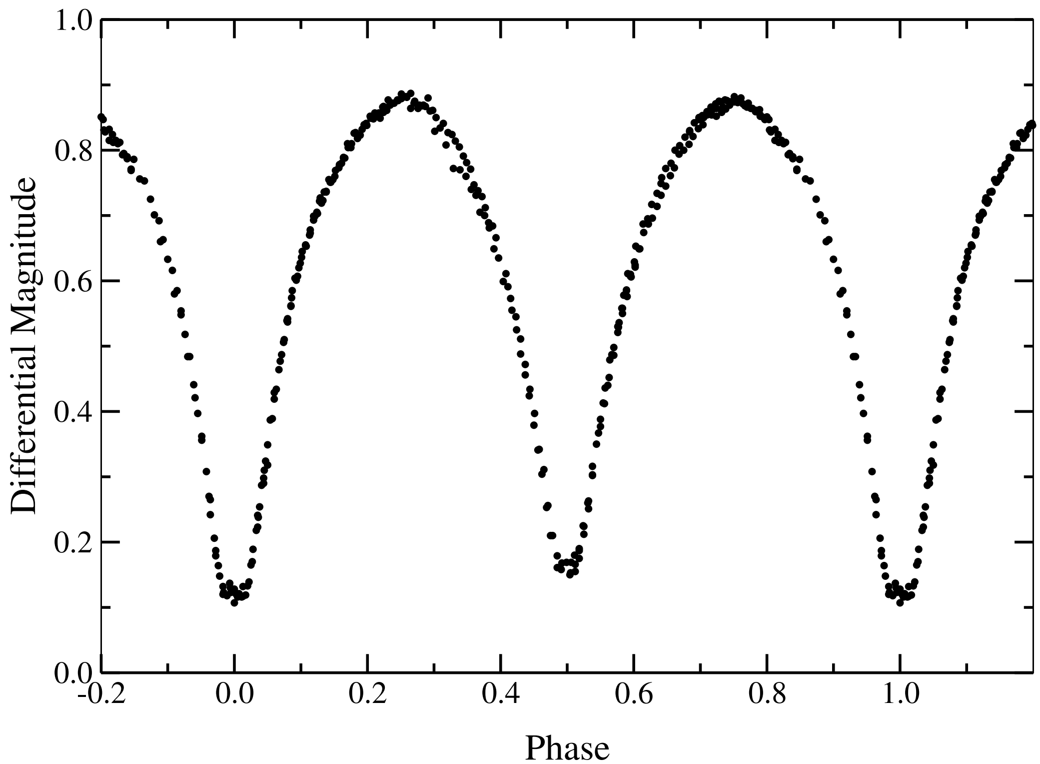

Figure 1. Differential phased light curve, GSC 2084.0777- unfiltered CCD - Lubcke.

The CCD light curve shows that the star is a W Ursae Majoris type (EW) eclipsing variable that is characterized by continuous light changes, with the primary and secondary minima being almost equal in depth.

The phase diagram of the folded Harvard photographic data is shown in Figure 2. These observations are available as 5228-t4.txt. Estimates were made by eye, and a sequence of steps was used to determine changes in brightness with respect to comparison stars GSC2084.0693 and GSC2084.1154.

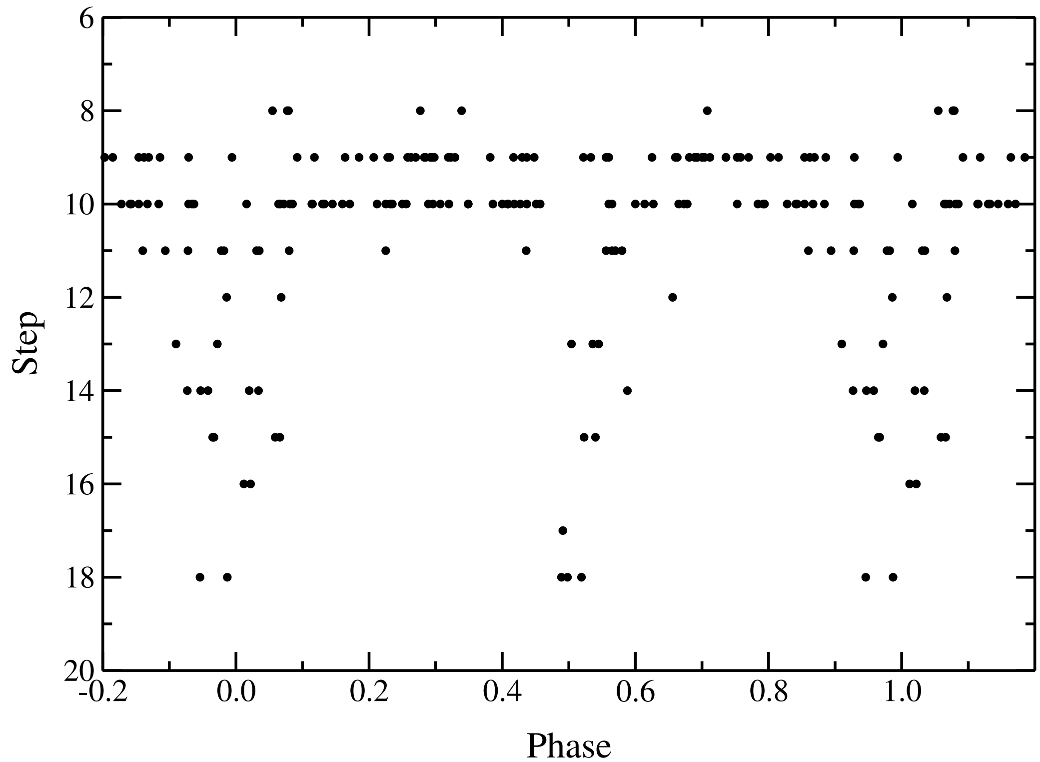

Figure 2. Phased Harvard light curve, GSC 2084.0777.

We wish to thank Alison Doane, acting Curator of the Astronomical Photograph Collection at the Harvard College Observatory, for use of the Harvard Patrol Plates. We also would like to thank Dr. Dirk Terrell of the Southwest Research Institute located in Boulder, Colorado USA, for his helpful suggestions, and Timothy Hager for drawing the light curves used in this report.

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LIGHT ELEMENTS AND LIGHT CURVE OF THE ECLIPSING BINARY GSC 2605.0545

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A group of AAVSO members continues to observe variables discovered by the ROTSE1 survey (Akerlof et. al., 2000). In this note, we report our findings that pertain to GSC 2605.0545 = ROTSE1 J172601.97 +304710.4. Our results include precision light elements and a light curve, as well as standard BVR_cI_c magnitudes for the variable and comparison stars.

The first reported period of the variable was $10^{\rm d}\!.93$ days, derived using the original CCD ROTSE1 data (Diethelm, 2000). Independently, Baldwin conducted a visual program to monitor the star. A total of 109 observations were made over 41 nights, and the star was seen in eclipse on three of those nights. About the same time, Guilbault and Hager examined 158 photographic plates of Harvard College Observatory, spanning the years 1931 to 1989. Their results suggested a period of $11^{\rm d}\!.0697$ days, rather than the shorter value of $10^{\rm d}\!.93$ days.

Five observers collected 621 CCD observations on 53 different nights, all between May 14 and October 30, 2001 except for two nights in October, 2000. All observers used the V filter, except Henden, who obtained standardized BVR_cI_c data. The table summarizes observers, equipment used, and the number of nights observed.

Observer	Telescope	Camera	Nights
Henden	1.00-m	SITe 1024 x 1024 (Tektronix)	5
Howell	0.46-m	ST-9E (SBIG)	35
Kaiser	0.36-m	ST-9E (SBIG)	2
Kuebler	0.36-m	IMG512 (FLI)	7
West	0.25-m	ST-8 (SBIG)	9

At the US Naval Observatory (USNO) Flagstaff Station, Henden used the 1.0-m telescope and an SITe Tektronix to observe a 11 × 11 arc-minute field surrounding GSC 2605.0545. The field included 124 stars whose magnitudes and colors were measured (Henden, 2001, see also 5229-t3.txt). The precision of the photometry was better than 0.01 magnitude for objects brighter than V = $15^{\mathrm{m}}_{.}0$. Two stars were chosen to be the comparison (GSC 2605.0791) and check (GSC 2605.0693) stars, as shown in Table 1. The variable's RA and DEC coordinates (J2000) are $17^{\mathrm{h}}26^{\mathrm{m}}02^{\mathrm{s}}_{.}13$ and $+30°47'13''_{.}33$, respectively. Astrometry was performed using USNO-A2.0 (Monet et. al., 1998), with internal errors under 100 milli-arcseconds.

Table 1. Comparison and check stars

Star	RA (J2000)	DEC	V	$B-V$	$V-R_c$	R_c-I_c
Comp	17:25:52.57	+30:47:03.19	11.956	0.969	0.530	0.465
Check	17:26:20.30	+30:46:29.37	11.752	0.933	0.533	0.451

Henden observed a primary eclipse on the evening of June 29/30, 2001. Seven hours of coverage centered on the middle of the eclipse were obtained, using BVR_cI_c passbands. The data showed that the eclipse is total, with a duration of 3.2 ± 0.1 hours. The minimum occurred at HJD = 2452090.8153 ± 0.0005, derived using the method of Kwee and van Woerden (1956). Figure 1 shows the light curve of the eclipse.

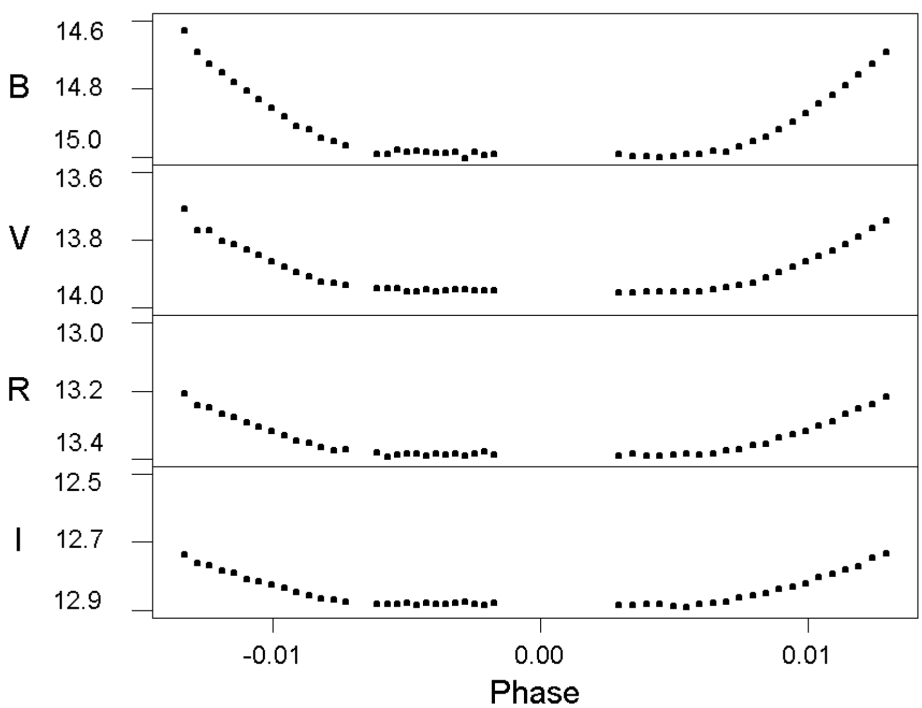

Figure 1. Primary eclipse of GSC 2605.0545 in $BVRI$ colors, 29/30 June 2001.

A key parameter of an eclipsing binary is its orbital period. Unfortunately, the three minima that Baldwin observed visually in the year 2000 could not discriminate between the two competing periods of $10^{\mathrm{d}}_{.}93$ days and $11^{\mathrm{d}}_{.}0697$ days proposed by Diethelm and Hager/Guilbault, respectively. The solution was to get more data. One year after

Baldwin's observations, Howell obtained CCD observations just after the variable passed through minimum phase. Then, during a dedicated period of observing from May-August, 2001, we were able to observe two different minima separated by five cycles. The results demonstrated that the longer period was correct.

To obtain a precise estimate of the period using all data, we pooled our observations, summarized in Table 2.

Table 2. Observed minima of GSC 2605.0545

HJD 2400000 +	S.E. (day)	Epoch	$O-C$	Observer	Type
43688.7390	0.1400	−759	−0.047	Harvard	photographic
51725.6200	0.0400	−33	+0.110	Baldwin	visual
51747.6200	0.0400	−31	−0.029	Baldwin	visual
51758.6900	0.0400	−30	−0.029	Baldwin	visual
52090.8153	0.0005	0	0.000	Henden	CCD
52146.1634	0.0054	+5	−0.004	Howell	CCD

We used the *AVE* program (Barbera, V2.5) to obtain the time of minimum light from the CCD data. This software implements the method of Kwee and van Woerden (1956) to calculate minimum light and the standard error (S.E.). To assess Baldwin's visual observations, which were made at random times and dates (109 observations total), we used a different approach. On three different occasions, he observed the star near minimum. If any given observation were phased randomly within the 3.2 hour duration of the total eclipse, then the standard error could be estimated using the properties of the uniform distribution. This turned out to be $0\overset{d}{.}04$ day (1.0 hour). A similar method was used to estimate the standard error of the one photographic plate when the variable appeared to be close to minimum. The error was estimated as $0\overset{d}{.}14$ day (3.4 hours).

Using a least squares analysis, we fitted a linear model to the observed HJD times of minimum. The observations were weighted by the inverse square of the standard errors. Model fits and residuals ($O-C$) were computed using *Minitab* statistical software. The $O-C$ values in Table 2 were calculated using the light elements from the least squares fit:

$$\begin{array}{ll}\text{Min. I} = \text{HJD } 2452090.8153 + 11\overset{d}{.}0699 \times E. \\ \qquad\qquad\qquad\qquad \pm 0.0008 \quad \pm 0.0003\end{array}$$

Examination of the $O-C$ residuals shows that everything fits well, with the possible exception of Baldwin's first visual observation. It lies nearly three standard errors from the fitted value. His observing notes suggest that the variable was observed after the minimum had occurred, so the positive residual makes sense. All other residuals are consistent with their standard errors, and we conclude that the calculated model is good.

The long period of the variable challenged us to obtain precision photometry over the many nights needed to obtain the light curve. The V light curve in Figure 2 suggests that the system is an Algol-type variable. Our data shows that the star fades from a maximum of $V = 12\overset{m}{.}50 \pm 0\overset{m}{.}01$ to $V = 13\overset{m}{.}95 \pm 0\overset{m}{.}01$ at primary minimum. A secondary minimum appears to occur at phase 0.50, although we did not completely cover the secondary eclipse. By extrapolating from our data at phase 0.49, we estimate that the magnitude at secondary minimum is $V = 12\overset{m}{.}85 \pm 0\overset{m}{.}04$. The duration of the primary minimum is 30 ± 3 hours, and the duration of the total eclipse is 3.2 ± 0.1 hours.

Analysis of the light curve using the Wilson-Devinney program (Wilson and Devinney, 1971; Wilson, 1979) is underway and will be published separately, but preliminary results indicate that the mass ratio is far from unity and that the system is detached. The totality of the primary eclipse and the appreciable amount of ellipsoidal variation do severely reduce the available parameter space. We are confident that high-quality, multi-bandpass photometric data coupled with radial velocities will result in unambiguous parameters for this system.

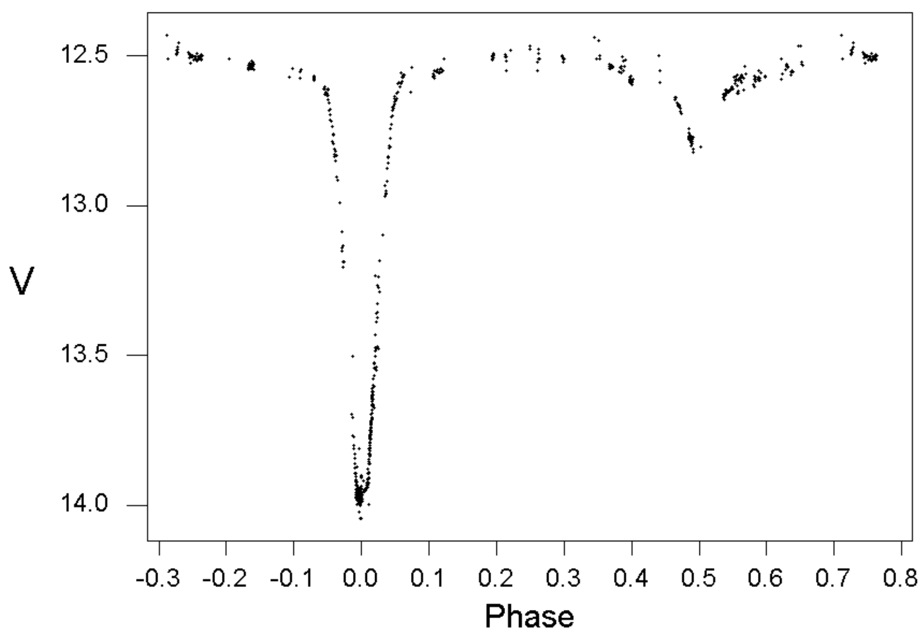

Figure 2. Phased light curve, GSC 2605.0545- *V*-filtered CCD.

We thank Dan Kaiser (Crescent Moon Observatory) for his submission of two nights of CCD data. We also thank Alison Doane, acting Curator of the Harvard College Observatory Astronomical Photograph Collection, for the use of the plates on this and other variable star projects.

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TIMES OF MINIMA OF ECLIPSING BINARIES

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Observatory and telescope:
1m RCC telescope of the Konkoly Observatory; 0.85m Cassegrain telescope of the Xinglong Station of the Beijing Astronomical Observatory.

Detector:	1024 × 1024 pixels Photometrics or 1152 × 770 pixels Wright CCD camera on the 1m RCC telescope. These cameras were cooled electronically. For variables observed by the 0.85m telescope see Zhou (2001).

Method of data reduction:
IRAF/DAOPHOT[1] package

Method of minimum determination:
Kwee & van Woerden (1956)

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
IM Aur	EA	05 15 30	+46 24 22	GSC 03358-01208	38327.7922	1.2472906	1
TV Cas	EA	00 19 19	+59 08 21	GSC 03665-00026	44602.4534	1.8125956	2
AH Cnc	EW	08 51 38	+11 50 54	GSC 00814-01981	41740.7166	0.36044098	2
ES Cnc	EA	08 51 21	+11 53 25	GSC 00814-01425	44643.2535	1.0677978	3
EV Cnc	EW	08 51 29	+11 49 31	GSC 00814-01311	51603.2028	0.4483	4
V861 Her	EW	16 51 13	+41 17 58	GSC 03079-00194	43684.325	0.3446322	5
XZ Leo	EW	10 02 34	+17 02 47	BD +17°2163a	45025.3540	0.48773685	6
V404 Lyr	EB	19 19 06	+38 22.0	GSC 03121-01597	35836.448	0.7309432	7
AH Tau	EW	03 47 12	+25 07.0	Mel 22 - HHJ 417	47000.2689	0.33267164	8
EQ Tau	EW	03 48 13	+22 19 22	Mel 22 AK I-1-170	40213.3250	0.34134848	2

[1] IRAF is distributed by the National Optical Astronomical Observatories, operated by the Association of the Universities for Research in Astronomy, inc., under cooperative agreement with the National Science Foundation

Source(s) of the ephemeris:
1. Bartolini & Zoffoli (1986), 2. General Catalogue on Variable Stars, Kholopov et al. (1998), 3. Goranskij et al. (1992), 4. Present paper, 5. Antipin (1996), 6. Niarchos et al. (1996), 7. Csizmadia & Sándor (2001), 8. Pribulla et al. (2001)

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
IM Aur	51563.401	.0015	II	V	−0.005	1m RCC
	51568.3863	.0004	II	V	−0.0085	”
	51570.2574	.0005	I	V	−0.0084	”
	51606.4224	.0005	I	V	−0.0148	”
	52247.5284	.0003	I	V	−0.0269	”
TV Cas	51925.3255	.0004	I	V	−0.0141	”
AH Cnc	51585.1847:	.0002	II	V	−0.0762	0.85m Cassegrain
ES Cnc	51602.0961	.0003	I	V	+0.0043	”
	51603.1655	.0004	II	V	+0.0059	”
EV Cnc	51603.2028	.0002	I	V	0.0000	”
	51604.0883	.0003	I	V	−0.0111	”
V861 Her	51690.5276	.0002	I	mean (VRI)	+0.0520	1m RCC
	51695.5268	.0006	II	mean (VRI)	+0.0540	”
XZ Leo	52274.5538	.0002	I	V	−0.0330	”
V404 Lyr	52106.51253	.00006	I	V	−0.00016	”
AH Tau	52246.33511	.00005	II	R	+0.00141	”
EQ Tau	52232.3484	.0006	II	V	−0.0244	”
	52232.5192	.0003	I	V	−0.0243	”
	52247.3679	.0002	II	mean(VRI)	−0.0243	”

Acknowledgements:

This work has been supported by OTKA Grant T034551. KV and VZ thank the hospitality of the staff of the Konkoly Observatory.

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Pribulla, T., Vanko, M., Parimucha, S., Chochol, D., 2001, *IBVS*, No. 5056

Zhou, A. Y., 2001, *IBVS*, No. 5096

ERRATUM FOR IBVS 5230

In IBVS 5230 we published several times of minima. One is corrected here. Instead of:

```
XZ Leo 52274.5538 .0002 I V -0.0330 "
```

the following should read:

```
XZ Leo 52274.5955 .0002 I V +0.0054 "
```

Szilárd Csizmadia

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GSC 0983.1044: A SHORT-PERIOD RS CVn BINARY

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M. Baldwin, chairman of the AAVSO eclipsing binary committee, initiated an observing program to study stars from the ROTSE 1 sky survey (Akerlof et al., 2000). Baldwin chose those stars that were likely eclipsing binaries and did not appear elsewhere in the literature. Once eclipses were confirmed visually, he asked AAVSO CCD observers to time eclipses and to construct accurate light curves so that periods, types and amplitudes could be defined.

One such star, GSC 0983.1044 = ROTSE 1 J165241.80 +124905.2, was listed in the ROTSE catalogue as a 13^{th} magnitude eclipsing star with a period of $0\overset{d}{.}40763$ and an amplitude of 1.022 magnitudes. After eclipses were confirmed visually by Baldwin, Henden used the USNO1.0-m telescope with a SITe 1024 × 1024 thinned, backside illuminated CCD and Johnson-Cousins BVR_cI_c filters along with Landoldt standards to determine standard magnitudes for the variable at maximum and comparison stars. These data are gathered in Table 1 and the errors in the last decimal place are given in parenthesis. GSC 0983.1313 was chosen as the comparison and GSC 0983.0566 as the check star. Astrometry is based on USNO-A 2.0 and has less than 100mas internal errors.

Table 1. Standard magnitudes and color indices,Henden

Star	GSC	RA	DEC	V	$B-V$	$V-R_c$	R_c-I_c
Variable[1]	0983.1044	16:52:41.80	+12:49:05.3	12.901(1)	0.775(3)	0.460(2)	0.438(3)
Comparison	0983.1313	16:52:33.70	+12:47:37.9	13.015(1)	0.627(2)	0.380(2)	0.366(4)
Check	0983.0556	16:52:19.09	+12:50:44.2	12.218(1)	0.943(3)	0.534(2)	0.431(3)

1 = at phase 0.11

More complete photometric information about all stars within 5 arcmin of the variable can be found in 5231-t4.txt at the *IBVS* website.

Pullen observed GSC 0983.1044 with his 0.28-m SCT + ST-6 CCD + V filter. Kaiser used his 0.35-m SCT + ST-9E CCD + V filter. A total of 6 times of minimum were obtained.

Guilbault and Hager visited the Harvard College Observatory and examined 58 blue-sensitive plates. Observations were made by eye, using a sequence of steps to estimate the changes in brightness. Two instances of faint light were found.

Table 2. Times of minimum, GSC 0983.1044

HJD	Error	Cycle	$O-C$	Observer	Type
2400000 +	+/−	Cycle	$O-C$	Observer	Type
45901.652		−7195	−0.002	PG/TH	pg
46116.891		−6931	+0.001	PG/TH	pg
51738.7197 †	(4)	−35.5	−0.001	ACP	CCD
51740.7594	(4)	−33.0	0.000	ACP	CCD
51747.6883 †	(2)	−24.5	−0.001	DHK	CCD
51753.8028	(2)	−17	−0.001	ACP	CCD
51767.6641	(1)	0	0.000	DHK	CCD
52084.8118	(1)	+389	0.000	DHK	CCD

† Secondary minimum

The CCD times of minimum were determined with the software AVE (Barbera 2000) based on the Kwee and Van Woerden method (Kwee - Van Woerden 1956). The time of minimum from the Harvard data is the mid-point of the exposure. A least squares solution with the CCD minima weighted as 10 and the photographic data as 1 results in the new elements:

$$\begin{array}{rl}\text{Min. I} = \text{HJD } 2451767.6637 + & 0^{\rm d}.81528987 \times E. \\ \pm 0.0001 \pm & 0.00000006\end{array}$$

This period is very close to twice the ROTSE 1 period. All data are phased to these elements and are shown in Figure 1. The maximum magnitudes at phases 0.25 and 0.75 differ by $0^{\rm m}.07$ V suggesting the possibility of spots. Indeed when Kaiser's year 2000 observations are compared to his 2001 data at phase 0.9, they differ on the order of 0.04 magnitudes in V. Such seasonal variations are typical of RS CVn binaries.

Solutions to the 2000 light curve using equatorial spots were done with the Wilson-Devinney light curve program (Wilson and Devinney, 1971; Wilson, 1979; Wilson, 1990). The effective temperature of the primary (5300 K) was chosen to be consistent with our rough spectral type estimate based on the outside-eclipse $B-V$ value. The composite $B-V$ of the system at maximum light is about $0^{\rm m}.8$ and the monochromatic luminosity ratio in V from our light curve solution is about $0^{\rm m}.6$. Although we do not have full light curves in B to compute the color of the individual components precisely, it is clear that the $B-V$ of the primary should be a bit less than $0^{\rm m}.8$ and the $B-V$ of the secondary should be a bit more than $0^{\rm m}.8$. *Astrophysical Quantities* (2000) gives a $B-V$ of $0^{\rm m}.74$ for a G8 V star and a $B-V$ of $0^{\rm m}.81$ for a K0 star. Therefore we estimate that the primary is mid-to-late G-type and the secondary is an early K-type, making the system an RS CVn binary (Morgan and Eggleton, 1979). A single-spot solution could not achieve a fit to the light curve, but a two-spot model does fit reasonably well as seen in Figure 2. The solution indicates that the system is detached and has large spots on the secondary component, again indicative of an RS CVn system.

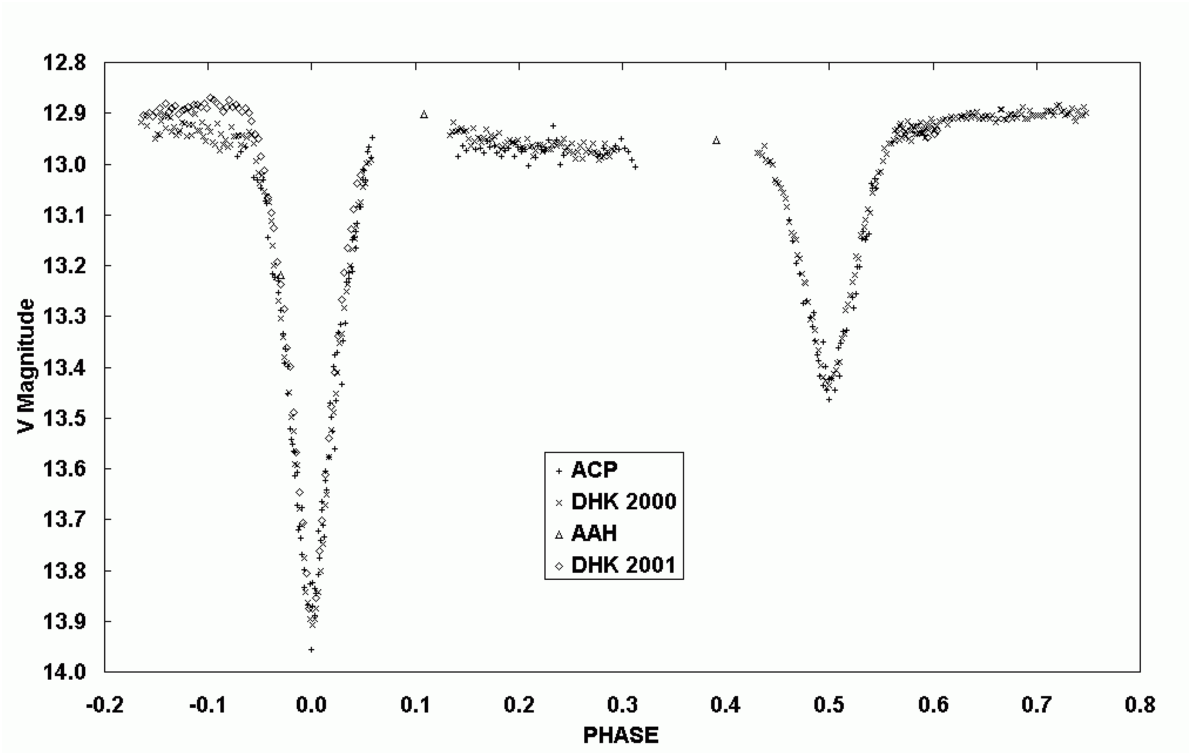

Figure 1. Phased light curve, GSC 0983.1044.

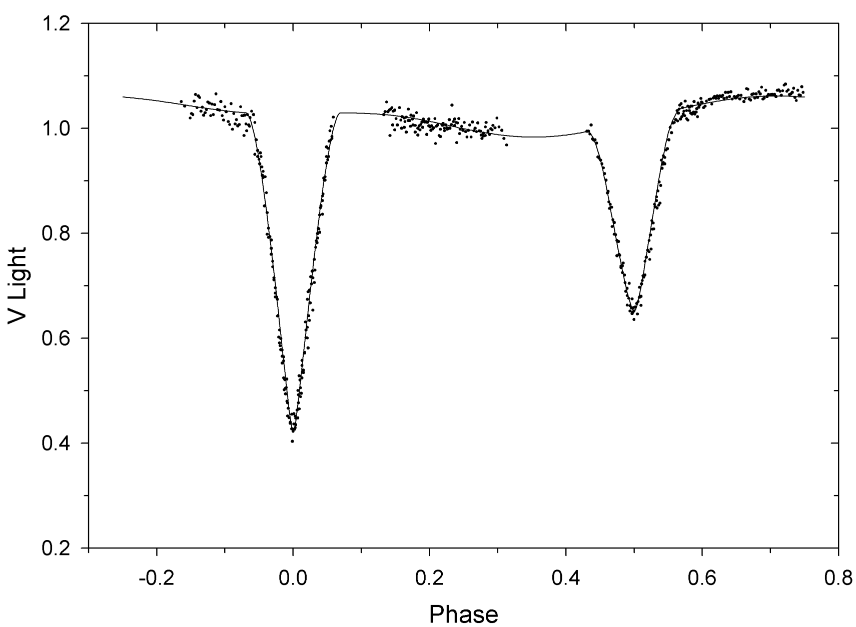

Figure 2. The two-spot light curve solution, GSC 0983.1044.

Table 3 shows the various parameters from the best-fit solution but with data in only one filter, the parameters should be considered preliminary, especially the spot parameters as attested by their large errors. High-precision *UBVRI* photometry should enable us to reliably determine the spot parameters (e.g., Samec and Terrell, 1995) and a radial velocity study would be needed to confirm that the mass ratio is near unity.

Table 3. Parameter values and errors for the best-fit solution

Parameter	Value
i	$89\overset{\circ}{.}2$ +/−$0\overset{\circ}{.}5$
$\Delta\ T$	417 K +/−88K
q	1.0 (assumed)
Ω_1	5.71 +/− 0.08
Ω_2	5.94 +/− 0.05
$L_1/(L_1+L_2)$	0.628 +/− 0.13
$g_1 = g_2$	0.32 (assumed)
$A_1 = A_2$	0.5 (assumed)
Spot 1 longitude	1.09 rad +/− 0.86
Spot 1 radius	0.85 rad +/− 0.52
Spot 1 temperature factor	0.94 +/− 0.02
Spot 2 longitude	3.58 rad +/− 2.89
Spot 2 radius	0.26 rad +/− 0.31
Spot 2 temperature factor	0.87 +/− 0.19

We wish to thank Alison Doane, acting Curator of the Astronomical Photograph Collection at the Harvard College Observatory, for use of the Harvard Patrol Plates.

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CCD LIGHT CURVES OF ROTSE1 VARIABLES, XIII: GSC 3104:1384 Lyr, ROTSE1 GSC 2632:319 Lyr, GSC 3540:85 Lyr AND GSC 3549:929 Dra

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Observatory and telescope:
Private observatory Schüsselacher, Wald, 0.15-m Starfire refractor

Detector:	SBIG ST-7 CCD camera

Method of data reduction:
Standard CCD-frame reduction using AIP4WIN software

Method of minimum determination:
Kwee – van Woerden algorithm

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp./check star(s)
GSC 3104:1384 ROTSE1 J182434.81+381740.5	EW	18 24 34.8	+38 17 40	GSC 3104:1605 / GSC 3104:1364
GSC 2632:319 ROTSE1 J183053.78+340814.1	EW	18 30 53.8	+34 08 14	GSC 2632:310 / GSC 2632:263
GSC 3540:85 ROTSE1 J184654.98+450054.7	EW	18 46 55.0	+45 00 55	GSC 3540:108 / GSC 3130:2796
GSC 3549:929 ROTSE1 J185835.38+500928.9	EW	18 58 35.4	+50 09 29	GSC 3549:941 / GSC 3549:772

Ephemeris:

Star name	E 2400000+	P [day]	Source
ROTSE1 J182434.81+381740.5	52121.3763	0.300395	present paper
ROTSE1 J183053.78+340814.1	52135.5275	0.355682	”
ROTSE1 J184654.98+450054.7	52146.5105	0.299632	”
ROTSE1 J185835.38+500928.9	52146.5052	0.349668	”

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
GSC3104:1384 (Lyr)	51259.8436	20	p?	none		ROTSE1
	51312.8599	20	s?	none		ROTSE1
	52121.3755	7	p	none		
	52121.5253	10	s	none		
	52135.3420	6	s	none		
	52135.4939	9	p	none		
	52146.4590	8	s	none		
	52171.3890	6	s	none		
	52179.3522	9	p	none		
	52181.3045	9	s	none		
	52181.4533	18	p	none		
	52187.3125	6	s	none		
GSC2632:319 (Lyr)	51297.8955	8	p	none		ROTSE1
	52121.4790	6	s	none		
	52135.3487	2	s	none		
	52135.5276	16	p	none		
	52143.3516	14	p	none		
	52146.3771	9	s	none		
	52179.2782	12	p	none		
	52179.4563	5	s	none		
	52181.4077	15	p	none		
	52187.2813	9	s	none		
	52187.4555	28	p	none		
GSC3540:85 (Lyr)	51291.8144	22	s	none		ROTSE1
	51295.8617	11	p	none		ROTSE1
	52121.4906	7	s	none		
	52135.4254	8	p	none		
	52143.3650	16	s	none		
	52146.3616	12	s	none		
	52146.5110	14	p	none		
	52171.3810	9	p	none		
	52179.3187	7	s	none		
	52179.4698	5	p	none		
	52181.4200	11	s	none		
	52187.4135	6	s	none		
GSC3549:929 (Dra)	51261.8434	10	p	none		ROTSE1
	51312.7233	10	s	none		ROTSE1
	52121.5054	2	s	none		
	52135.4915	10	s	none		
	52143.3595	7	p	none		
	52146.3321	18	s	none		
	52146.5054	6	p	none		
	52171.3344	17	p	none		
	52179.3735	4	p	none		
	52181.2972	14	s	none		
	52181.4720	22	p	none		
	52187.4128	14	p	none		

Explanation of the remarks in the table:
ROTSE1: Observations of Akerlof et al. (2000).

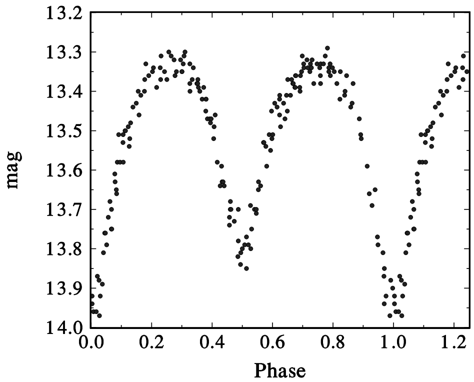

Figure 1. CCD light curve (without filter) of GSC 3104:1384

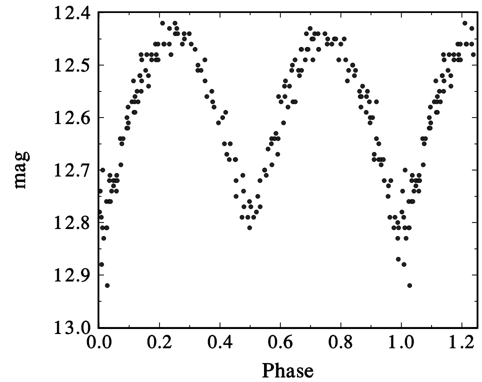

Figure 2. CCD light curve (without filter) of GSC 2632:319

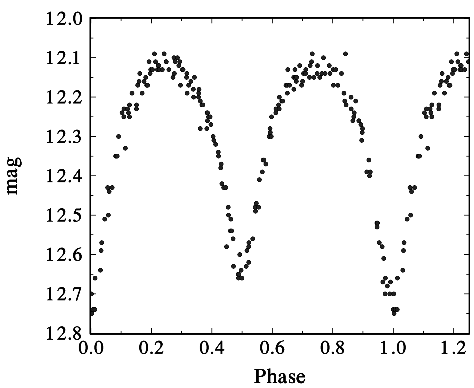

Figure 3. CCD light curve (without filter) of GSC 3540:85

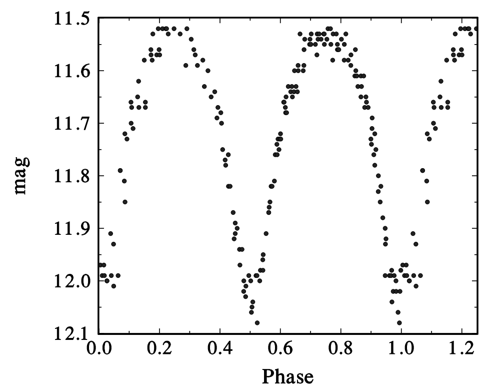

Figure 4. CCD light curve (without filter) of GSC 3549:929

Remarks:
As a byproduct of the ROTSE1 CCD survey, a large number of new variables have been discovered (Akerlof et al., 2000). In a series of papers, we report unfiltered CCD observations for some of the close binary systems (type EW) in the list of Akerlof et al. (2000). This installment contains information on four variables in the constellations Lyra and Draco. The four stars were observed with our CCD equipment during 8 nights between JD 2452121 and JD 2452187. A total of 201 CCD frames were measured of GSC 3104:1384 (VAR 1), 199 frames of GSC 2632:319 (VAR 2), 198 frames of GSC 3540:85 (VAR 3) and 195 frames for GSC 3549:929 (VAR 4). Figures 1 through 4 show our observations folded with the elements given in the table of Ephemeris. These elements of variation are deduced from a linear fit to the normal minima from the ROTSE1 data and the timings of minimum derived from our data given in the table of Times of minima and also in Blättler (2001).

Availability of the data:
Upon request from diethelm@astro.unibas.ch

Acknowledgements:
This research made use of the SIMBAD data base, operated at CDS, Strasbourg, France

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Blättler, E., 2001, *BBSAG Bulletin*, **126**

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PERIOD AND PROPER MOTION OF 1RXS J232953.9+062814

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Early in November 2001 an outburst of this dwarf nova system was reported (Uemura et al. 2001). These authors also report the detection of superhumps with a period of $0\overset{d}{.}046311(12)$ and estimate a proper motion of $0\overset{\prime\prime}{.}1$/year. The latter is of special interest, as it gives a hint that this object might be one of the nearest symbiotic binary systems. We have investigated the object to improve those values. CCD photometry was obtained at the Innsbruck 60-cm RC telescope during two runs on November 15, 2001 and December 10, 2001 using a Johnson R filter. Data reduction and source extraction were performed as described in Bacher et al. (2001). We obtained differential photometry relative to the star USNO 0900-20419578. Weak cirrus clouds during the first run did not allow an absolute calibration at that time. During the other run 12 exposures of the nearby standard star HD 220954 were taken. They have an rms of $0\overset{m}{.}024$ (and thus $0\overset{m}{.}017$ for the zero point error). Using this calibration we were able to calibrate the comparison star to $13\overset{m}{.}76\pm0\overset{m}{.}03$. This is in good agreement with the photographic red magnitude of $13\overset{m}{.}6$ given in USNO A2 and GSC2. Stacks of all images of a night were used to check the comparison star for long term stability by means of weak stars in the field. The photometry of 1RXS J232953.9+062814 (means of a night) yields

$$\text{JD 2452229.301 (Nov. 15, 2001):} \quad m_\mathrm{R} = 15\overset{m}{.}57\pm0\overset{m}{.}04$$
$$\text{JD 2452254.258 (Dec. 10, 2001):} \quad m_\mathrm{R} = 15\overset{m}{.}80\pm0\overset{m}{.}03$$

Although the decline clearly indicates a remnant of the outburst activity during the first night, we were unable to find the superhumps of up to $0\overset{m}{.}3$ as reported during the earlier phase (Uemura et al. 2001). A frequency analysis using the PDM method (Stellingwerf 1978) shows only a very low probability of a period at $0\overset{d}{.}046$. A better solution is found with $0\overset{d}{.}022584$. Visual inspection (Figs. 1 and 2) shows indeed that the latter period is more likely. It is clearly visible during the second night too, when the object had already declined to quiescence. The amplitudes are comparable for both nights.

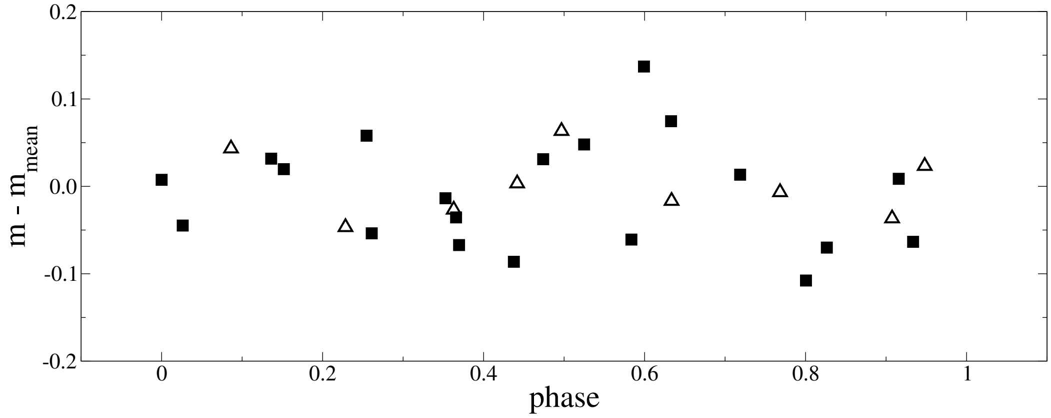

Figure 1. The photometry derived during the two nights folded with the period of $0\overset{d}{.}04631112$ (Uemura et al. 2001) and the first of our observations as zero point. The squares indicate the observations of November, the triangles those of December. No indications of this period are found.

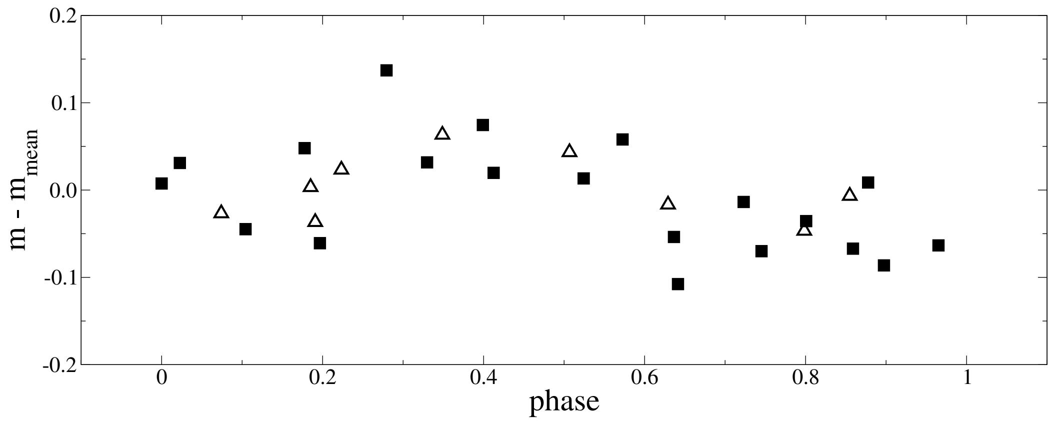

Figure 2. The same as above but folded with a period of $0\overset{d}{.}022584$. There is a clear sign of periodicity. As the two observations are 110 periods apart, the quality of the period is very good.

Accurate astrometry based on 18 stars with $R < 18\overset{m}{.}5$ surrounding the target within 12 arcminutes was derived on 7 digitized survey plates. The epochs of the plates are given in Table 1. The stars include the astrometric calibration stars AC2000 2052132 (= TYCHO-2 125895) and AC2000 2052114.

Table 1. The epochs of the plates used for the astrometry.

Type	Description	Plate Number	Epoch
DSS-1	POSS-E Red Plate	XE582	1951.607
DSS-1	Quick-V Northern	N582	1983.612
DSS-1	Quick-V Northern	N612	1983.683
DSS-2	POSS-II Red	XP822	1986.77
DSS-2	POSS-II Blue	XJ821	1992.572
DSS-2	POSS-II Blue	XJ822	1992.747
DSS-2	POSS-II Red	XP821	1993.639

The rms of the reference frame stars is $0.''15$ for the DSS-1 plate and less than $0.''09$ for the other plates. This allows us to derive the position from the combination of the 7 plates to an accuracy of $0.''04$ and of the proper motion to an accuracy of $0.''005$/year (alpha) and $0.''003$/year (delta). The total proper motion is $0.''056 \pm 0.''005$/year and thus about a factor of two below that estimated by Uemura et al. (2001).

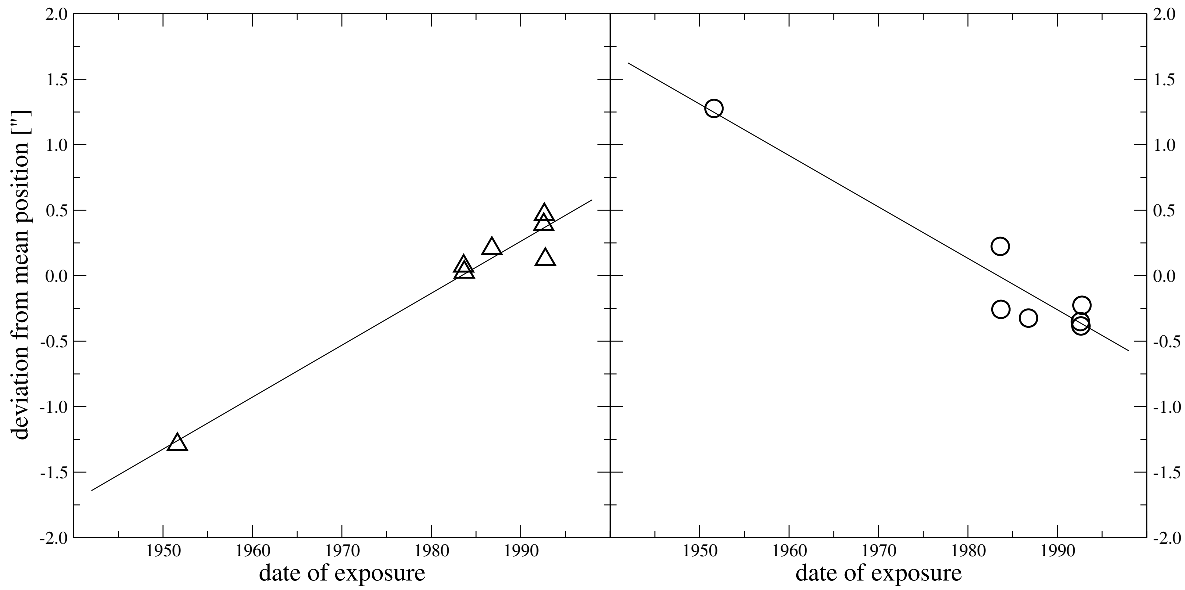

Figure 3. The positions of 1RXS J232953.9+062814 relative to the mean position on all 7 frames; left: declination; right: right ascension.

The coordinates below are calculated for epoch and equinox J2000.0, using the mean position using all plates (epoch 1981.859) and the obtained proper motion.

$$\alpha_{\mathrm{J2000.0}} = 23^{\mathrm{h}}29^{\mathrm{m}}54.^{\mathrm{s}}402 \pm 0.^{\mathrm{s}}04 \qquad \mathrm{PM}_{\alpha} = -0.''039 \pm 0.''005/\mathrm{year}$$
$$\delta_{\mathrm{J2000.0}} = 06^{\circ}28'07.''89 \pm 0.''04 \qquad \mathrm{PM}_{\delta} = +0.''040 \pm 0.''003/\mathrm{year}$$

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GSC 650_475 AND GSC 650_769: TWO NEW VARIABLE STARS

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Name of the object:
GSC 650_475

Equatorial coordinates:	**Equinox:**
R.A.= $03^h29^m14\overset{s}{.}73$ **DEC.=** $+09°11'20\overset{''}{.}4$	J2000

Name of the object:
GSC 650_769

Equatorial coordinates:	**Equinox:**
R.A.= $03^h28^m25\overset{s}{.}77$ **DEC.=** $+09°04'23\overset{''}{.}6$	J2000

Observatory and telescope:
Les Engarouines Observatory (IAU astrometric code 164), 0.212m Newton telescope

Detector:	KAF 1600 CCD

Filter(s):	None, roughly *R*

Transformed to a standard system:	No

Availability of the data:
Upon request

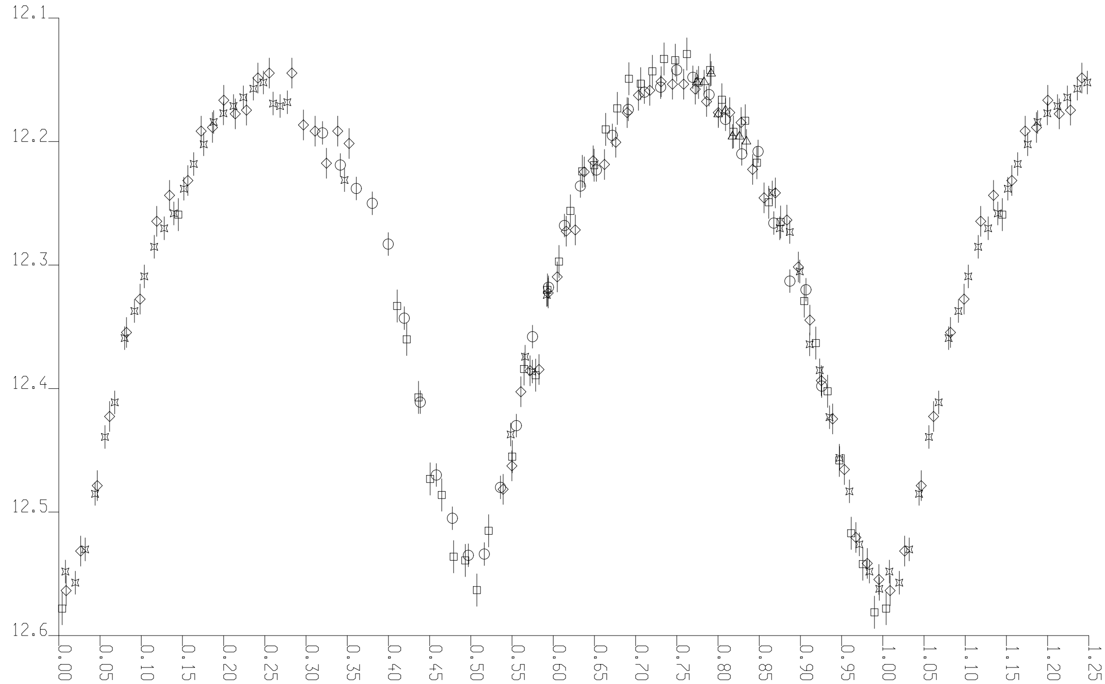

Figure 1. Unfiltered light curve of GSC 650_475

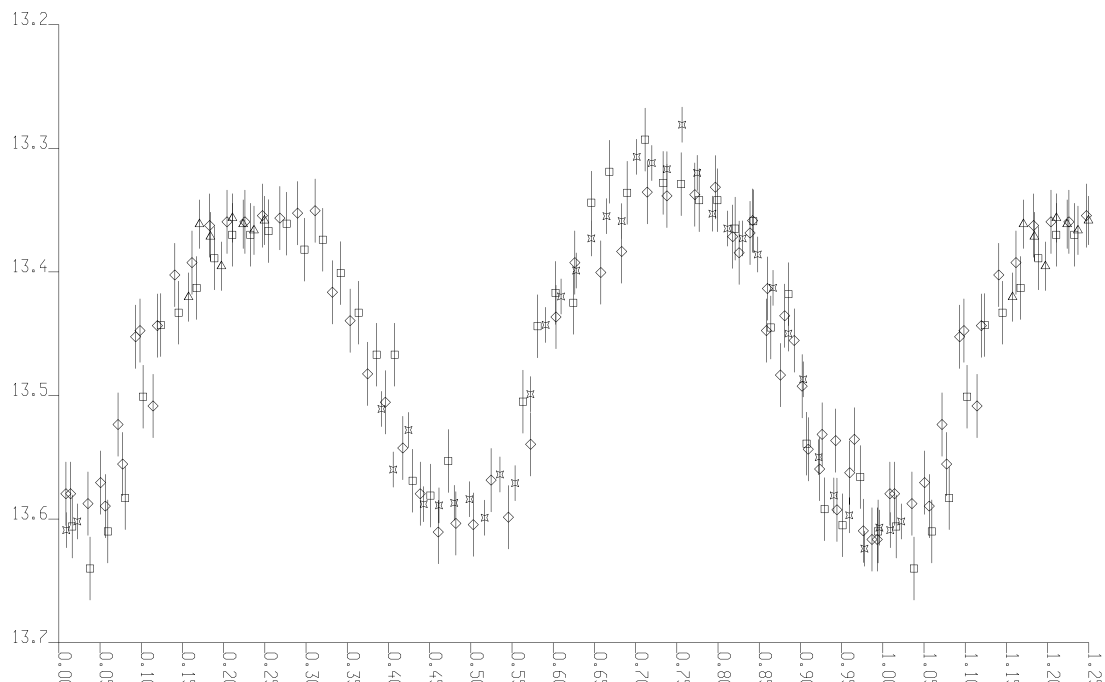

Figure 2. Unfiltered light curve of GSC 650_769

Remarks:

GSC 650_475 was found to be a variable star by Bernasconi on CCD frames taken around 2001 Dec. 20.0 UT (circles in Figure 1) for the successful determination of the asteroid (404) Arsinoe's lightcurve. The variability of GSC 650_769 was found analysing the frames obtained during the three next nights around Dec. 21.0, 21.9 and 22.9 (squares, diamonds and stars in Figures 1 and 2). The periods of the two objects were refined using observations at about 2002 Jan. 11.0 (triangles). The analysis of the observations was done with the `CourbRot` software (Behrend, 2001), in a manner very similar to the one described in Behrend, Buil, Antonini & Demeautis (2002); the main results are as follows:

For GSC 650_475:

$$\begin{aligned} \text{HJD of a principal minimum} &= 2452264.9819 \pm 0.0004 \\ \text{Period} &= 0\overset{\text{d}}{.}44713 \pm 0\overset{\text{d}}{.}00007 \\ \text{Total variation} &= 0.42 \pm 0.01\,\text{mag} \\ \text{Probable type of variability} &= \text{EW/KW} \end{aligned}$$

For GSC 650_769:

$$\begin{aligned} \text{HJD of a principal minimum} &= 2452265.8573 \pm 0.0012 \\ \text{Period} &= 0\overset{\text{d}}{.}29172 \pm 0\overset{\text{d}}{.}00010 \\ \text{Total variation} &= 0.30 \pm 0.01\,\text{mag} \\ \text{Probable type of variability} &= \text{EW} \end{aligned}$$

Reference:

Behrend, R., 2001, *Orion*, **304**, 12
Behrend, R., Buil, Ch., Antonini, P., Demeautis, Ch., 2002, *IBVS* 5219

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THE VARIABILITY OF THE ORBITAL PERIOD OF RZ COMAE BERENICES

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The variable star RZ Com (BD +24° 2475) is a W UMa-type eclipsing binary that belongs to the W sub-class. Although it is not a faint binary, ($V_{max} = 10\overset{m}{.}5$), it cannot be characterised as a well observed system. Its spectral classification is not clear, since:
1) in the old study by Struve & Gratton (1948) the system is referred as K0;
2) Wood's et al. catalogue (1980) gives F7 for the primary and G0 for the secondary component, respectively;
3) Batten's et al. (1989) gives G2Vn; and
4) in Hipparcos catalogue the system is referred to as G0Vn.

On the other hand, the more recent spectroscopic study of RZ Com (McLean & Hilditch, 1983), does not give the spectral types of the two components.

From the $O-C$ diagram of the system, which is presented in Fig. 1, it is obvious that its orbital period undergoes an obvious increase during the last two decades.

From all available data, given in Table 1, and from the weighted quadratic least squares fitting, we found:

$$\text{Hel. JD(Min I)} = 2434837.4211 + 0\overset{d}{.}33850481 \times E + 3.69 \times 10^{-11} \times E^2$$

that yields to a period increase of the order of $1\overset{d}{.}84 \times 10^{-11}$. This increase becomes a little greater $1\overset{d}{.}91 \times 10^{-11}$, if we do not take into account five points with very large scatter. These points are marked with asterisk in Table 1.

The C values, in the $O-C$ differences of Table 1, have been calculated using Kholopov's (1985) ephemeris formula:

$$\text{Hel. JD(Min I)} = 2434837.4198 + 0\overset{d}{.}33850604 \times E$$

According to some old studies (Broglia 1960, Aslan & Herczeg 1984), the period of RZ Com was constant from 1934 till 1966, and equal to 0.3350604 days; while, the predominantly negative residuals from 1969 were perhaps indicating a change in the system's period (Aslan & Herczeg 1984). At the same time, Rovithis & Rovithis-Livaniou (1984), proposed a new ephemeris with a slightly bigger value for the orbital period of RZ Com. The present analysis not only confirms this, but also shows that this increase continues.

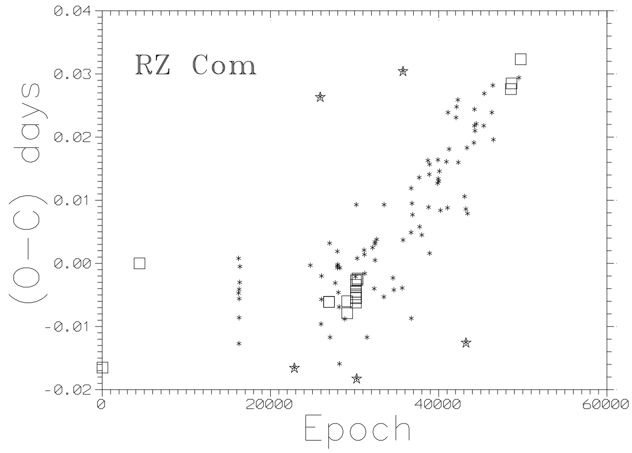

Figure 1. The $O-C$ diagram of RZ Com, based on all available data, and to Moscow (1985) ephemeris formula. Squares have been used for photoelectric minima and small stars for the visual ones. The 5 visual points that were not taken into account are plotted with bigger stars.

Most of the minima in Table 1, are visual; and although it is better to avoid using such data (because of their pure accuracy and usually large dispersion), in this particular case it is impossible to do otherwise, since the photoelectric material is very poor. New times of minimum light are needed to follow the orbital period behaviour of this interesting and rather neglected binary.

Acknowledgement: The authors thank Dr. K. Olah for her assistance. This work was partly supported financially by Athens University (grant No. 70/4/3305), and has made use of the Simbad database, operated at CDS, Strasbourg, France.

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
RZ Com	34847.899		I		−0.017	Koch R.H., 1961.
	36341.4021		I		0.0000	Broglia P., 1960.
	40323.588		I		0.001	Baldwin M.E., 1973.
	40324.598		I		−0.005	Baldwin M.E., 1973.
	40338.638		II		−0.013	Baldwin M.E., 1973.
	40346.597		I		−0.009	Baldwin M.E., 1973.
	40347.617		I		−0.004	Baldwin M.E., 1973.
	40348.631		I		−0.006	Baldwin M.E., 1973.
	40369.621		I		−0.003	Baldwin M.E., 1973.
	40380.625		II		−0.001	Baldwin M.E., 1973.
	42571.420*		II		−0.017	Diethelm R., 1977.
	43213.413		I		−0.000	Peter H., 1977.
	43612.369*		II		0.026	Peter H., 1979.
	43642.460		II		−0.010	Peter H., 1979.
	43656.512		I		−0.006	Peter H., 1979.
	44008.383		II		−0.012	Peter H., 1979.
	43663.455		II		−0.002	Peter H., 1979.
	43964.8906		I		−0.0061	Aslan Z. & Herczeg T.J., 1984.
	43967.9372		I		−0.0061	Aslan Z. & Herczeg T.J., 1984.
	43988.426		II		0.003	Peter H., 1979.
	44214.711		I		−0.003	Locher K., 1980.
	44299.681		I		0.002	Locher K., 1980.
	44303.402		I		−0.001	Peter H., 1980.
	44316.435		II		−0.000	Locher K., 1980.

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
RZ Com	44339.449		II		−0.005	Peter H., 1980.
	44370.420		I		−0.007	Peter H., 1980.
	44382.428		II		−0.016	Peter H., 1980.
	44402.415		II		−0.001	Peter H., 1980.
	44595.701		II		−0.009	Locher K., 1981.
	44694.3712		I		−0.0060	Derman E. et al., 1982.
	44695.3868		I		−0.0079	Derman E. et al., 1982.
	45027.465		I		−0.002	Locher K., 1982.
	45046.4173		I		−0.0062	Rovithis & Rovithis−Livaniou, 1984.
	45046.5878		II		−0.0049	Rovithis & Rovithis−Livaniou, 1984.
	45047.2652		II		−0.0045	Rovithis & Rovithis−Livaniou, 1984.
	45047.4336		I		−0.0054	Rovithis & Rovithis−Livaniou, 1984.
	45047.6027		II		−0.0055	Rovithis P. & Rovithis−Livaniou E., 1984.
	45049.2974		II		−0.0034	Rovithis & Rovithis−Livaniou, 1984.
	45049.4673		I		−0.0027	Rovithis & Rovithis−Livaniou, 1984.
	45061.327		I		0.009	Germann R., 1982.
	45076.363*		II		−0.018	Peter H., 1982.
	45100.416		II		0.001	Peter H., 1982.
	45109.3832		I		−0.0024	Rovithis & Rovithis−Livaniou, 1984.
	45110.3985		I		−0.0026	Rovithis & Rovithis−Livaniou, 1984.
	45378.500		I		0.002	Locher K., 1983.
	45389.670		I		0.001	Locher K., 1983.
	45404.392		II		−0.002	Peter H., 1983.
	45493.409		II		−0.012	Germann R., 1983.
	45718.699		I		0.002	Locher K., 1984.
	45781.316		I		−0.004	Germann R., 1984.
	45815.341		II		0.003	Germann R., 1984.
	45812.466		I		0.003	Peter H., 1984.
	45818.387		II		0.000	Peter H., 1984.
	45884.399		II		0.004	Peter H., 1984.
	46171.443		II		−0.005	Peter H., 1985.
	46180.428		I		0.009	Peter H., 1985.
	46535.340		II		−0.002	Germann R., 1986.
	46573.420		I		−0.004	Germann R., 1987.
	46908.372		II		−0.004	Germann R., 1987.
	46939.529*		II		0.030	Peter H., 1987.
	46941.384		I		0.004	Peter H., 1987.
	47266.351		I		0.005	Germann R., 1988.
	47275.477		I		−0.009	Kirby G., 1991.
	47270.420		I		0.012	Peter H., 1988.
	47303.422		II		0.010	Peter H., 1988.
	47323.392		II		0.008	Blattler E., 1989.
	47592.341		I		0.014	Peter H., 1989.
	47612.305		I		0.006	Blattler E., 1989.
	47695.407		II		0.004	Peter H., 1989.
	47946.421		I		0.016	Peter H., 1990.
	47969.432		I		0.009	Peter H., 1990.
	48001.426		II		0.014	Peter H., 1990.
	48010.398		I		0.016	Peter H., 1990.
	48014.446		I		0.002	Peter H., 1990.
	48329.437		II		0.013	Peter H., 1991.
	48348.397		II		0.016	Peter H., 1991.
	48358.380		I		0.013	Peter H., 1991.
	48385.460		I		0.013	Peter H., 1991.
	48404.418		I		0.015	Peter H., 1991.
	48447.402		I		0.008	Peter H., 1991.
	48686.395		I		0.016	Peter H., 1992.
	48733.440		I		0.009	Peter H., 1992.
	48753.427		I		0.024	Peter H., 1992.

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
RZ Com	48795.396		I		0.018	Peter H., 1992.
	49076.361		I		0.023	Peter H., 1993.
	49097.350		I		0.025	Peter H., 1993.
	49147.450		I		0.026	Peter H., 1993.
	49167.412		I		0.016	Peter H., 1993.
	49416.547		I		0.011	Dedoch A., 1995a.
	49471.385		I		0.009	Peter H., 1994.
	49475.424*		I		−0.012	Peter H., 1994.
	49516.414		I		0.018	Paschke A., 1994.
	49537.391		I		0.008	Peter H., 1994.
	49793.482		II		0.019	Dedoch A., 1995b.
	49810.410		II		0.022	Martignoni M., 1996.
	49817.352		I		0.024	Peter H., 1995.
	49840.367		I		0.021	Peter H., 1995.
	49888.436		I		0.022	Peter H., 1995.
	50188.352		I		0.022	Peter H., 1996.
	50210.360		I		0.027	Peter H., 1996.
	50517.382		I		0.024	Peter H., 1997.
	50557.330		I		0.029	Peter H., 1997.
	50578.478		II		0.020	Dedoch A., 1997.
	51281.9016		II		0.0276	Diethelm R., 2001.
	51312.8758		I		0.0285	Diethelm R., 2001.
	51609.408		I		0.029	Paschke A., 2000.
	51676.7736		I		0.0323	Nelson R.H., 2001.

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Peter H., 1977, 1979, 1980, 1982, 1983, 1984, 1985, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997 in *BBSAG* **Nos. 33, 37&43, 47&48, 60, 65, 72&73, 76, 84, 88, 91, 94&95, 97&98, 101, 104, 106&107, 109, 112, 114 &115**.

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NEW ELEMENTS OF THE CONTACT BINARY V839 OPHIUCHI

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V839 Oph as a W UMa type contact binary system was first detected by R. Rigollet in 1947. According to the *General Catalogue of Variable Stars* (GCVS Kholopov et al., 1985) the spectral type of the system is F8V with the period P=$0^{\rm d}.40899532$. So far a lot of studies have been conducted on the period variation and light curve analysis of V839 Oph (see especially Akalin & Derman, 1997). The first spectroscopic observations of this system were done by Rucinski and Lu in 1999. They found that the mass ratio of the system (q=m_2/m_1) is 0.305 with the spectral type of F7V.

The authors made new photoelectric observations of V839 Oph in 2000. The light curves and times of minima resulted from our observations are given in IBVS (No. 5190, 2001). We used the latest version of Wilson program (2001) in order to find simultaneous radial velocity and light curves solutions of the system.

The B, V magnitude differences were converted to intensities and used as a photometric input data. For radial velocity analysis we used the 29 observations provided by Rucinski & Lu (1999). The radial velocity curves along with the two (B, V) light curves were utilized simultaneously to determine the geometric and physical elements of the system.

For detailed analysis mode 3 of Wilson's (2001) program was used with constraints for gravity-darkening exponents g_1=g_2, the bolometric albedos A_1=A_2, the modified surface potentials of two components Ω_1=Ω_2, the limb darkening coefficients x_1=x_2, y_1=y_2. We supposed that there is neither a third light, $l_3 = 0.0$, nor any spot.

The parameters of Akalin & Derman (1997) were taken as a starting point. We used the bolometric logarithmic law of limb darkening for both components and the x and y parameters of the components were fixed to their theoretical values, as interpolated with VLimp program by Van Hamme (1993). Since the spectral type of this system is F7V, the temperature of the primary component was assumed to be T_1=6550K. The following parameters were free to be adjusted: the orbital inclination i; the mass ratio q; the temperature of secondary component T_2; the potential function Ω_1; the gravity darkening g_1; the bolometric albedos A_1; the monochromatic luminosity of primary component L_1; the semi-major axis a; and the systemic velocity V_γ. These nine parameters were varied until the solution converged.

Table 1 summarizes the adopted solution while Table 2 lists the values of the absolute dimensions of V839 Oph. Similarly Fig. 1 and Fig. 2 represent the light curves and radial velocity curves, respectively.

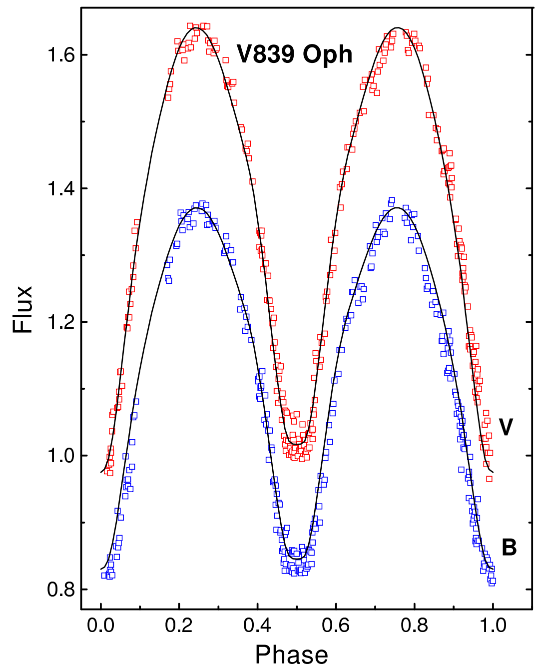

Figure 1. Open squares show the observed points and continuous lines show the model fit.

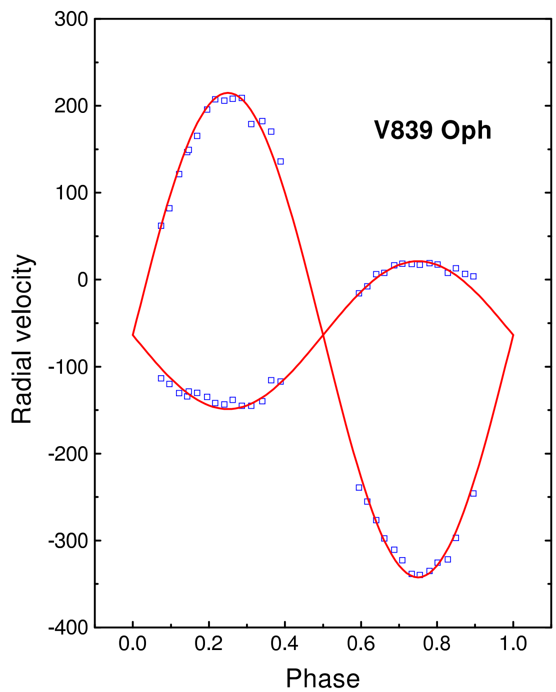

Figure 2. The same as Fig. 1 for radial velocity data.

Table 1: The Geometric and Physical elements of the contact binary system V839 Oph (most quantities are defined in the text).

Element	Value	Element	Value
i	80.059 ± 0.378	q	0.305 ± 0.001
$a(R_\odot)$	2.982 ± 0.005	$V_\gamma(km/s)$	-63.76 ± 0.33
$x_{1(bol)}=x_{2(bol)}$	0.641	$y_{1(bol)}=y_{2(bol)}$	0.242
$g_1 = g_2$	0.630 ± 0.044	l_3	0.00
$\Omega_1 = \Omega_2$	2.434 ± 0.007	$A_1 = A_2$	0.984 ± 0.115
$T_1(K)$	6650	$T_2(K)$	6554 ± 15
$L_{1B}/(L_1 + L_2)$	0.756 ± 0.004	$L_{2B}/(L_1 + L_2)$	0.243 ± 0.004
$L_{1V}/(L_1 + L_2)$	0.753 ± 0.004	$L_{2V}/(L_1 + L_2)$	0.243 ± 0.004
$r_{1(pole)}$	0.463 ± 0.004	$r_{2(pole)}$	0.271 ± 0.005
$r_{1(side)}$	0.500 ± 0.006	$r_{2(side)}$	0.284 ± 0.006
$r_{1(back)}$	0.528 ± 0.088	$r_{2(back)}$	0.325 ± 0.012

Table 2: Absolute dimension of V839 Oph calculated for mean values of Table 1.

Element	Primary	Secondary
$Mag_{(bol)}$	3.31	4.51
$M(M_\odot)$	1.64	0.5
$R(R_\odot)$	1.48	0.88
$L(L_\odot)$	3.51	1.14

In a nutshell, the present study of the V839 Oph showed that the system posseses partial eclipses and is a A-type contact binary with a degree of overcontact of $f = (\Omega_{in} - \Omega_{1,2})/(\Omega_{in} - \Omega_{out}) \cong 23\%$. According to Kopal (1959), the relation $r_1 + r_2 = 0.75$ should be fulfilled for contact system; therefore, taking the mean values of r_1 and r_2, we have $r_1 + r_2 = 0.79$. As a result, V839 Oph is an overcontact system which has two stars overfilling their respective Roche lobes.

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SPECTROSCOPIC ORBIT OF THE ECLIPSING BINARY V2031 Cyg IN THE FIELD OF THE OPEN CLUSTER NGC 6913≡M 29

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NGC 6913 is inserted in the list of young open clusters that are studied spectroscopically in high resolution from Asiago to the aim of investigating their internal kinematics, deriving their galactic motion and detecting and solving their binaries. This long term program is described in Munari (1992), and first results have been published by Tomasella and Munari (1998), Munari and Tomasella (1999), Milone et al. (2000).

Here we present the spectroscopic orbit of the eclipsing star V2031 Cyg (HD 194378) in the field of NGC 6913≡M 29. The membership of V2031 Cyg to NGC 6913 is astrometrically possible according to Sanders (1973). However, we derived for NGC 6913 a radial velocity RV=-17.1 ± 0.9 km sec^{-1}, with an internal dispersion of $\sigma = 2.7 \pm 0.1$ km sec^{-1}. The barycentric velocity of V2031 Cyg that we derive here is RV=$+8.65 \pm 0.48$ km sec^{-1}, apparently ruling out any physical partnership with the open cluster. The chance superposition of V2031 Cyg onto the line-of-sight to NGC 6913 is also supported by the proper motion of the star as measured by Hipparcos/Tycho that turned out to be significantly different from that of the cluster. Also the studies of NGC 6913 by Crawford et al. (1977) and Joshi et al. (1983) does not support the membership because in their color-magnitude diagrams V2031 Cyg falls off the expected position.

Hipparcos detected the star as a variable, with a range $8.66 \leq H_p \leq 8.76$ mag, but could not determine the type of variability and derive a period for it. Prompted by the alignment of V2031 Cyg with NGC 6913 and by the fact that a few radial velocity measurements by Liu et al. (1989) suggested a binary nature for it, Kim and Lee (1996) monitored V2031 Cyg in V band with a CCD camera and independently discovered the variable nature. Their data show a single *eclipse*–like event and did not allow the determination of any periodicity.

We have obtained 19 high resolution spectra of V2031 Cyg over the 1996-2001 period, using the 1.82 m telescope and its Echelle+CCD spectrograph operated by the Astronomical Observatory of Padova at Asiago (Cima Ekar). A journal of the observations is given in Table 1. The spectra have been extracted and calibrated in a standard fashion using the IRAF reduction package and the radial velocities were obtained from measurements of seven spectral lines (of FeI and MgI), fitted individually with Gaussian profiles. Reference wavelengths were taken from Moore (1959). The resulting radial velocities are listed in Table 1.

We determined the spectroscopic orbit by setting the eccentricity to zero, as a preliminary analysis with eccentricity as a free parameter did not support a different value. The orbital solution is given in Table 2 and in graphical form in Figure 1 (upper panel). To derive it, we used only our data in Table 1. In fact, inclusion of the lower precision four measurements by Liu et al. (1989) did not change the solution at the expense of increasing the errors. Liu's data however well fit our solution (see Figure 1).

Table 1. Journal of observations and measured radial velocities.

Date	HJD 2400000+	disp at H_α	λ range	$RV_\odot$ km s^{-1}
28 Jun 1996	50263.422	0.38 Å/pix	4100-6700 Å	-32.7 ± 1.3
1 Aug 1996	50297.502	0.38 Å/pix	4100-6700 Å	$+18.1 \pm 1.2$
3 Aug 1996	50299.476	0.38 Å/pix	4100-6700 Å	$+67.4 \pm 1.3$
21 Aug 1996	50316.557	0.38 Å/pix	4100-6700 Å	$-\ 1.5 \pm 1.1$
28 Aug 1996	50324.473	0.38 Å/pix	4100-6700 Å	$+24.3 \pm 1.1$
6 Sep 1996	50333.426	0.38 Å/pix	4100-6700 Å	-52.4 ± 1.2
25 Jul 1997	50655.486	0.38 Å/pix	4100-6700 Å	-43.6 ± 1.1
11 Aug 1997	50671.557	0.38 Å/pix	4100-6700 Å	-50.6 ± 1.0
13 Aug 1997	50674.404	0.38 Å/pix	4100-6700 Å	-44.8 ± 0.7
13 Aug 1997	50674.488	0.38 Å/pix	4100-6700 Å	-38.4 ± 0.7
14 Aug 1997	50674.565	0.38 Å/pix	4100-6700 Å	-30.6 ± 0.7
14 Aug 1997	50675.392	0.38 Å/pix	4100-6700 Å	$+64.6 \pm 1.2$
9 Sep 1998	51066.390	0.38 Å/pix	4100-6700 Å	-51.8 ± 1.1
17 Dec 2000	51896.245	0.38 Å/pix	4500-9500 Å	-19.0 ± 1.4
30 Jul 2001	52121.480	0.19 Å/pix	4500-9500 Å	-35.9 ± 0.7
9 Sep 2001	52162.368	0.19 Å/pix	4500-9500 Å	$-\ 1.3 \pm 2.0$
29 Oct 2001	52212.436	0.38 Å/pix	4500-9500 Å	$+15.0 \pm 1.2$
2 Nov 2001	52216.308	0.38 Å/pix	4500-9500 Å	-17.4 ± 0.9
30 Nov 2001	52244.251	0.19 Å/pix	4500-9500 Å	$+68.2 \pm 1.5$

We have then phase plotted the Hipparcos photometric data according to the 2.70465 day orbital period. A fine *eclipse*–like shape is evident, with a primary eclipse with a depth of 0.10 mag and a secondary eclipse with a depth of 0.05 mag., confirming the preliminary suggestion by Kim and Lee (1996) about the nature of V2031 Cyg. The lightcurve based on Hipparcos data is plotted in Figure 1 (middle panel). It looks noisy because of the low amplitude coupled with the fact that V2031 Cyg is close to the fainter limit of Hipparcos H_p sensitivity where observational errors are higher. The noisy nature of Hipparcos lightcurve prevented us from a combined spectro/photometric solution of V2031 Cyg with a Wilson-Devinney code.

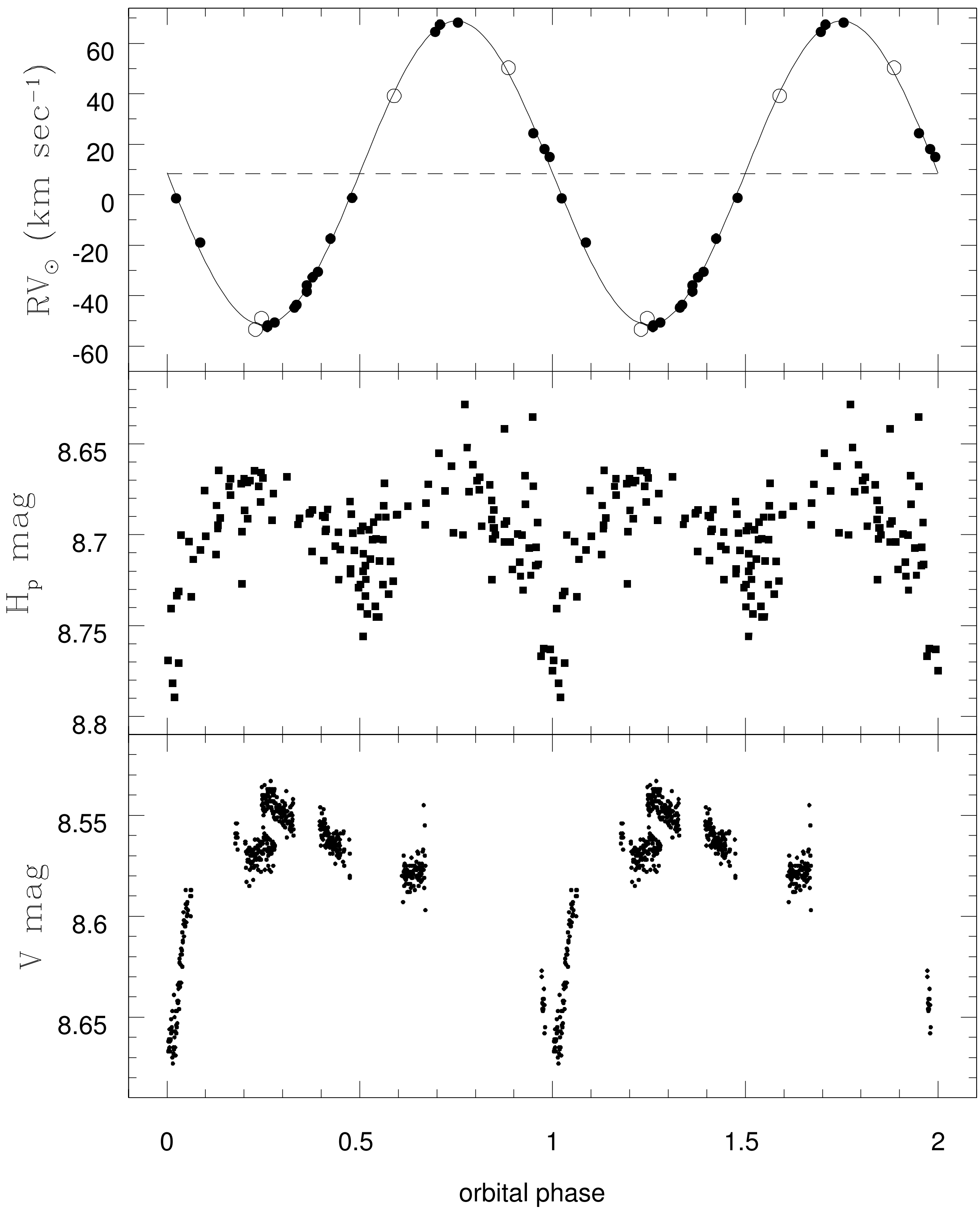

Figure 1. Radial velocity curve of V2031 Cyg (top). *Filled circles:* our measurements from Table 1. *Open circles:* Liu et al. (1989) data (four measurements on dates 25-11-1987, 26-11-1987, 30-09-1988, 01-10-1988). The dashed line gives the barycentric velocity. The middle and bottom panels are phase diagrams of the Hipparcos H_P data and the Kim and Lee (1996) V band photometry according to our orbital solution in Table 2.

Table 2. Orbital Elements for V2031 Cyg

Orbital Element		Value	error
P	(days)	2.70465	± 0.00001
e		0.000	
K	(km s^{-1})	60.19	± 0.71
γ	(km s^{-1})	+8.65	± 0.48
T_0	(HJD)	2451038.638	± 0.005
ω	(deg)	0.000	
$a \cdot \sin i$	(AU)	2.23	± 0.02
i	(deg)	$\simeq$90	
f(m)		0.061	± 0.002
RMS residual	(km s^{-1})	1.51	

In Figure 1 (bottom panel) the Kim and Lee (1996) data are phase plotted according to our orbital period of 2.70465 day (data kindly communicated privately by S.-L. Kim). They confirm the eclipsing nature of V2031 Cyg but they too do not allow a photometric solution because: (i) the out-of-eclipse data seems to suffer from variable zero-point problems, (ii) the primary eclipse is only partially covered and the secondary is entirely missed.

Given the object's brightness, position in the sky and already available spectroscopic data and orbital solution, V2031 Cyg well qualifies as an easy target for a devoted photometric investigation aimed to derive a combined spectro-photometric solution, that we encourage.

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HD 12582: A NEW δ Sct VARIABLE

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Name of the object:
HD 12582 = SAO 75119 = HIP 9644

Equatorial coordinates:	**Equinox:**
R.A.= $2^h3^m58\overset{s}{.}2$ **DEC.=** $+29°54'18''$	J2000.0

Observatory and telescope:
90 cm at Sierra Nevada Observatory, Spain

Detector:	Six channel $uvby\beta$ spectrograph photometer

Filter(s):	$uvby\beta$

Date(s) of the observation(s):
10 and 17 September 2001

Comparison star(s):	HD 11547 V=$7\overset{m}{.}5$, F0, HD 12273 V=$7\overset{m}{.}7$, F5

Transformed to a standard system:	$uvby\beta$
Standard stars (field) used:	$uvby\beta$ standard stars from Crawford & Mander (1966) and Crawford & Barnes (1970)

Availability of the data:
Upon request

Type of variability:	DSCT

Remarks:

The variability of HD 12582 was discovered during an observational program carried out on the Algol-type eclipsing binary system X Tri, where HD 12582 was used as a check star. This star presents a δ Sct-type photometric variability with a main period of about 2.0 hours (P=0.08 days), but secondary frequencies must not be ruled out. Different amplitudes are found for each of the four *uvby* filter for the main period: $0\overset{\rm m}{.}0083$, $0\overset{\rm m}{.}0140$, $0\overset{\rm m}{.}0113$ and $0\overset{\rm m}{.}0087$ with rates typical of δ Sct-type pulsators. The photometric Strömgren indices were calibrated to be $V=8\overset{\rm m}{.}251$, $b-y=0\overset{\rm m}{.}178$, $m_1=0\overset{\rm m}{.}175$, $c_1=0\overset{\rm m}{.}945$ and $\beta=2\overset{\rm m}{.}781$. From these indices and following the procedure outlined in a previous paper (Rodríguez & Rolland 2000) we found this star being a normal δ Sct star with nearly solar abundances.

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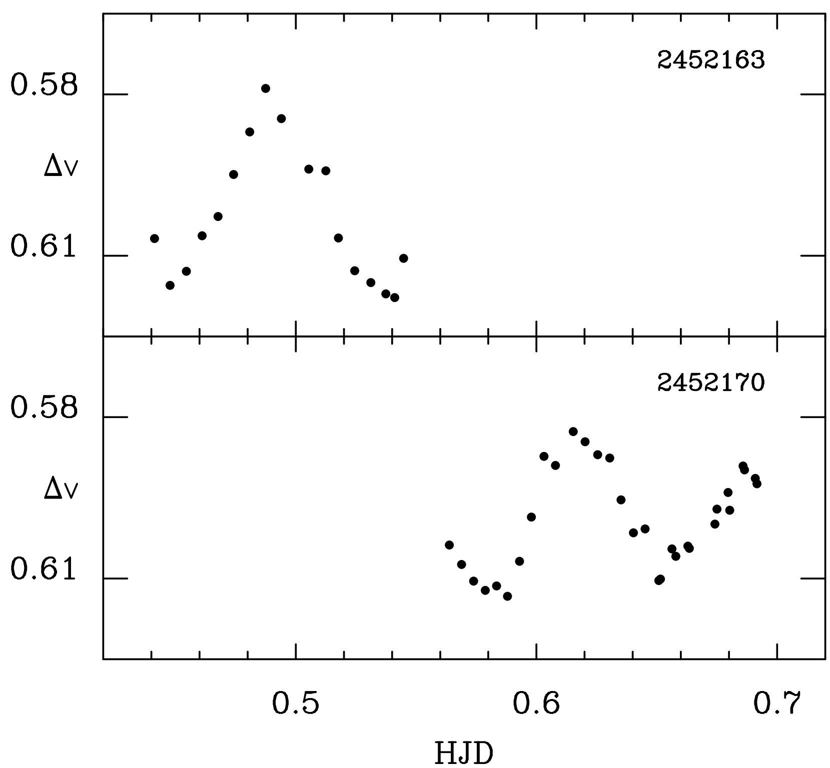

Figure 1. Differential light curves of HD 12582 relative to HD 11572 in the *v* filter versus Heliocentric Julian Day

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THE PRIMARY MINIMUM OF OW GEMINORUM IN 2002

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The light variation of the long-period eccentric Algol-type eclipsing binary OW Geminorum (=HDE 258878=BD+17°1281, sp. type F2 Ib-II, $V_{\rm max}$=8.2 mag, ΔV=1.8 mag, P≈1260 days) was discovered in 1988 by D.H. Kaiser during his photographic nova search (Kaiser et al. 1988). The first period determination was given by Kaiser (1988), while the high eccentricity was indicated for the first time by the secondary minimum observations of Williams (1989). Since the discovery, two primary minima, the first in 1991 (Williams & Kaiser 1991, Pravec 1992, Hanzl et al. 1993) and the second in 1995 (Hager 1996) were covered by visual, photoelectric and CCD observations. The most thorough analysis of the system was presented by Griffin & Duquennoy (1993, hereafter referred to as GD93), mostly based on radial velocity measurements. There is very few multicolour photometry in the literature and this fact initiated our observational efforts addressing the primary minimum in early 2002.

The ephemeris given by Williams & Kaiser (1991) predicted this year's minimum to occur on January 3, 2002. Our CCD photometric observations were carried out on 13 nights between Dec. 17, 2001 and Jan. 11, 2002. The data were obtained in two observatories. $BV(RI)_C$ photometry was done at Szeged Observatory with the 0.4-m Cassegrain telescope equipped with an SBIG ST–9E CCD camera (512×512 pixels). The exposure times were between 5 and 60 seconds, depending on the actual filter and target brightness. The majority of the data was recorded with the 60/90/180 cm Schmidt telescope mounted at the Piszkéstető Station of the Konkoly Observatory. The detector was a Photometrics AT200 CCD camera (1536×1024 pixels, KAF-1600 chip). Here the exposure times ranged from 2 to 20 seconds.

All data were reduced with standard tasks in IRAF[1]. We made aperture photometry with IRAF/DAOPHOT. Two nearby stars, already suggested for comparisons by Terrell et al. (1994), were chosen as comparison and check stars (comp = GSC 1332-0578, V=9.90 mag, $B-V$=+0.30 mag, check = SAO 95777, V=9.05, $B-V$=+0.230 mag, Hanzl et al. 1993). We used the fainter star as comparison because a 6-hour long continuous B-band photometry on Dec. 17, 2001 suggested slight (and ambiguous) changes of the brighter

[1] IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

Table 1: Differential magnitudes of OW Gem relative to GSC 1332-0578 (MJD=Hel.JD−2450000). "Sz" and "Pi" denote Szeged Observatory and Piszkéstető Station, respectively.

MJD	ΔB	ΔV	ΔR_C	ΔI_C	Obs.
2261.462	−1.25	−1.71	−1.90	−2.20	Sz
2266.349	−1.31	−1.65	−1.88	−2.13	Pi
2267.453	−1.32	−1.66	−1.88	−2.13	Pi
2271.528	−1.23	−1.57			Pi
2274.321	−0.78	−1.14			Pi
2275.498	−0.32	−0.80	−1.11	−1.41	Pi
2276.235	−0.07	−0.59	−0.90	−1.22	Pi
2277.273	0.41	−0.30	−0.61	−0.97	Pi
2278.189	0.44	−0.28	−0.64	−1.08	Sz
2278.387	0.45	−0.29	−0.66	−1.07	Sz
2279.240	0.05	−0.59	−0.92	−1.26	Sz
2279.320	0.03	−0.59	−0.94	−1.29	Sz
2281.303	−0.69	−1.19	−1.46	−1.78	Sz
2285.478	−1.31	−1.64		−2.14	Pi
2286.461	−1.32	−1.66		−2.12	Pi

star at a level of 0.02-0.03 mag. Although later data did not confirm this suspected variability, we have preferred the fainter star as the main comparison. To determine the standard transformation coefficients for both instruments, we obtained $BV(RI)_C$ band images of the open cluster M67, containing a widely used photometric standard sequence (Chevalier & Ilovaisky 1991). The estimated photometric accuracy based on the scatter of the standardized "comp minus check" data is ±0.03 mag in B, ±0.02 mag in V and ±0.01 mag in R_C and I_C bands. The whole dataset consists of 15 points in B and V, 11 points in R_C and 13 points in I_C band. All photometric data are presented in Table 1 and the light curves are plotted in Fig. 1.

We have determined the epoch of minimum by fitting low-order polynomials to the lower part of the light curves. Unfortunately, the weather did not permit observations on every night, thus the gaps make the epoch determination uncertain. The derived epoch is Hel.JD 2452277.73±0.20 giving $O-C$=$-0\overset{\text{d}}{.}29$ (with the ephemeris given below). More accurate moment requires more data obtained at different geographic longitudes which bridge the daily gaps in our light curves.

We have collected all available times of minimum from Williams & Kaiser (1991), Hanzl et al. (1993) and Hager (1996) in order to construct the updated $O-C$ diagram. It is completely linear and the points scatter around a straight line which has a non-significant slope of 0.01±0.02. Therefore, we conclude that the present ephemeris

$$\text{Hel.JD}_{\text{min}} = 2449760.857 + 1258.59 \times E$$

can be used to predict further minima.

In order to gain some insight into the physical nature of the components, we have tried to fit the observed light curves with a simple model. GD93 presented a detailed analysis of the system, including a light curve fit of the primary minimum observed by visual observers. We wanted to check whether their model can be extended to describe multicolour data, too. For this purpose, we computed model light curves with a programme written by LLK. The programme was not developed to match a light curve by

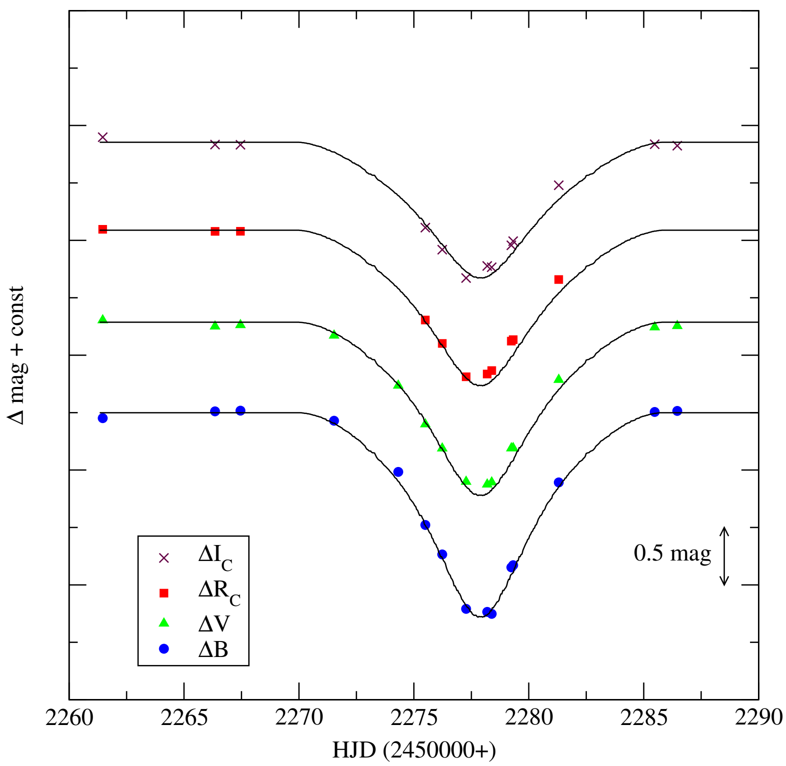

Figure 1. Standardized differential light curves of OW Gem with the adopted model light curves.

automatic iteration, but calculates light variations for a given model and enables the user to adjust the parameters of the model until a satisfactory convergence toward the observed curves are not found. The adjustable parameters include the sizes (under spherical assumption) and temperatures (assuming black-body radiation) of the two stars, and the minimum projected distance between the centers of the model stars ("impact parameter"). The relative transverse velocity is fixed by the known orbital elements. Standard linear limb-darkening coefficients for log $g = 1.0$, $T_{\rm eff}$=7250 K and 4500 K, computed for the $BV(RI)_C$ photometric bands, were taken from Diaz-Cordoves et al. (1995) and Claret et al. (1995). Standard $BV(RI)_C$ magnitudes were calculated by multiplying the computed fluxes with the filter transmission functions (Bessell 1990) and integrating over wavelength.

The spectral types of the components are known fairly accurately thanks to this direct detection in the spectrum (GD93). The brighter primary is of spectral type F2 Ia-II, while the secondary is a late G-type star (G8 according to GD93). We have adopted the following geometric parameters determined by GD93: R_1=30 $R_\odot$, R_2=35 $R_\odot$. The secondary moves with 66 km s^{-1} relative to the primary and the impact parameter is 10 $R_\odot$. The initial temperatures were T_1=7300 K and T_2=4600 K, corresponding to F2 and G8 of luminosity class I-II (Carroll & Ostlie 1996, Appendix E). Good fits (solid lines in Fig. 1) could be obtained for the same geometry with slightly different temperatures: $T_1^{\rm fit}$=7000±100 K, $T_2^{\rm fit}$=4900±100 K. (We noticed some asymmetry in the ascending branches of the light curves, most visible in R_C and I_C. Independent data are needed to decide whether it is real.) The corresponding luminosities are $L_1 \approx$1950 $L_\odot$, $L_2 \approx$ 640 $L_\odot$, giving visual absolute magnitudes $M_V^1 = -3.5$ mag and $M_V^2 = -2.0$ mag. These values are in good agreement with those of GD93, the only difference is the slightly hotter secondary. We conclude that presently available data are compatible with an F2-3 Ib-II primary and G4-5 IIb secondary.

The next secondary minimum will occur between Oct. 8 and Nov. 7, 2002. We urge CCD observers to follow this event by observing in as many photometric bands as possible. It is expected that multicolour coverage of both minima would improve the photometric modelling of the components giving a more accurate physical description of this interesting system.

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BV(RI)$_C$ OBSERVATIONS OF SOME DWARF NOVAE

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Dwarf Novae (DN) are erupting cataclysmic variable stars. The 2-6 mag outbursts last from few days to more than a month and the recurrence times can be as short as a few days and as long as 30 years (see e.g. Warner 1995). According to differences in their outburst light curves, they are divided into three sub-groups, the U Gem stars (UG), the SU UMa stars (SU) and Z Cam stars (ZC). The U Gem systems have normal outbursts which last a few days to weeks. In SU UMa systems, except for normal outbursts, there are so-called superoutbursts which last weeks and occur more regularly than the normal ones. In Z Cam systems, during decline from some outbursts, so-called standstills are observed in which the systems stay at a brightness level somewhat below maximum for a prolonged interval of time, before returning to quiescence.

In this brief paper we present a sample of photometric B, V, R_C, I_C observations of dwarf novae made in the years 1993-1997 with the 0.40 m Automatic Imaging Telescope at the Perugia Astronomical Observatory (Tosti et al. 1996). The telescope is mainly devoted to the monitoring of a large sample of blazars (Fiorucci and Tosti 1996), however, a fraction of the telescope time is dedicated to the photometric observations of DNe. The instruments used and the photometric techniques have been already described in Spogli et al. (1998). Part of the data were elaborated by the Associazione Astronomica Umbra, using the usual IRAF photometric packages. For many DNe we used the calibration stars reported in Misselt (1996), moreover we calibrated them with the I_C filter, by observing, on photometric nights, several standard stars (Landolt, 1992) having $(B-V)$ from $-0\overset{m}{.}2$ to $1\overset{m}{.}4$ over a wide range of airmass. The same Landolt stars were used to compute the standard magnitude for the other DNe during the photometric nights.

The data (Table 1) were obtained during the years in which we worked to automatize the telescope. Sometimes the weather conditions varied suddenly or the telescope blocked and therefore, in some cases observations exist only in one filter or in some of the filters. However, these data are always important since, joined to other photometric observations, can be used to draw the historical light curve.

The dwarf novae selected have been observed in different phases of luminosity: some of them were in outburst, others at minimum. For some dwarf novae, that were in outburst at the time of the observations, we calculated the spectral slope α (see table 2) using the same procedure used in Spogli et al. (1998), neglecting interstellar reddening.

Table 1: $BV(RI)_C$ magnitudes of some Dwarf Novae

Name	Type	Date UT	JD (2449000+)	B	V	R_C	I_C
KW And	UG	95/09/29	990.816			17.3±0.3	
RX And	ZC	94/10/18	644.405		13.50±0.05		
		94/10/30	657.476	11.45±0.05	11.24±0.05	11.09±0.05	9.87 ±0.02
		94/11/04	662.426	11.29±0.09	11.15±0.05	11.13±0.05	10.95±0.03
		94/11/04	662.441	11.25±0.08	11.17±0.05	11.12±0.05	10.91±0.02
		94/12/15	703.341	12.23±0.08	12.21±0.05	12.05±0.05	11.71±0.02
AK Cnc		95/01/12	729.555			15.82±0.08	
	UG	95/02/02	750.434		15.92±0.08	15.77±0.07	15.51±0.06
YZ Cnc	SU	95/01/12	729.621	13.11±0.06	13.21±0.06	13.35±0.06	13.13±0.05
SS Cyg	UG	94/10/18	644.362		12.24±0.05		
		94/11/09	667.239		12.51±0.05		
V503 Cyg	UG	95/07/06	905.497			14.69±0.07	
V516 Cyg	UG	97/07/06	1636.552		17.2±0.3	16.9±0.2	16.7±0.2
		97/08/06	1667.527	15.04±0.13	15.17±0.09	14.69±0.06	14.68±0.08
		97/08/15	1676.461		16.7±0.3	16.5±0.2	15.52±0.07
		97/08/19	1680.449	15.84±0.12	14.93±0.09	14.91±0.08	14.43±0.06
		97/08/21	1682.441		17.8±0.3	16.7±0.3	16.3±0.2
		97/08/31	1692.455		16.4±0.2	16.1±0.2	15.75±0.07
		97/09/01	1693.437		16.3±0.2	15.88±0.09	15.08±0.07
		97/09/02	1694.421	13.98±0.09	13.81±0.04	13.71±0.09	13.69±0.08
V542 Cyg	UG	95/07/06	905.525			16.4±0.2	
V792 Cyg	UG	95/07/01	900.562			15.85±0.09	
V811 Cyg	UG	95/07/01	900.585			16.1±0.2	
		95/07/13	912.495		15.24±0.08	15.03±0.05	14.88±0.06
		95/07/16	915.556		15.71±0.07	15.32±0.06	15.33±0.07
		95/07/21	920.506			15.71±0.05	
		95/08/03	932.435			15.18±0.05	
		95/09/29	990.648		17.2±0.3	16.4±0.2	16.1±0.2
V823 Cyg	UG	95/07/23	912.517			14.96±0.08	
V1006 Cyg	UG	95/08/03	932.443			16.1±0.2	
V1028 Cyg	UG	95/08/03	932.465	13.65±0.08	13.86±0.05	13.76±0.07	13.69±0.06
V1251 Cyg	UG	95/09/27	988.754			15.01±0.08	
V1316 Cyg	SU	95/07/01	900.602		17.3±0.3	16.5±0.2	16.3±0.2
		95/07/16	915.478	16.4 ±0.3	16.3 ±0.2	16.1 ±0.1	15.92±0.06
		95/08/23	953.321		16.1±0.09	15.84±0.08	15.34±0.04
V1390 Cyg	SU	95/07/16	915.568		16.6±0.2	15.86±0.09	15.13±0.07
V1504 Cyg	SU	95/07/21	920.543			14.38±0.06	
U Gem	UG	93/02/03	022.361		14.45±0.05		
		93/03/17	064.331		14.30±0.07		
		93/12/30	352.367		11.44±0.05		
		94/11/17	674.592		14.18±0.05		
AH Her	ZC	94/04/28	470.449	13.97±0.09	13.80±0.05	13.57±0.05	13.01±0.03
		94/04/29	471.432	13.66±0.09	13.38±0.04	13.04±0.04	12.75±0.03
		94/05/01	473.466	12.67±0.09	12.56±0.05	12.39±0.04	12.26±0.03
		94/05/15	488.467	13.91±0.08		13.41±0.04	13.07±0.04
		94/05/21	494.513	12.87±0.07	12.62±0.05	12.45±0.04	12.27±0.03
		94/06/02	506.377	13.41±0.12	13.36±0.06	13.07±0.05	12.86±0.05
		94/06/06	510.457	12.71±0.07	12.23±0.08	11.84±0.04	11.72±0.03
		94/06/16	520.407	13.80±0.10	13.76±0.05	13.33±0.04	12.80±0.04
		94/06/17	521.475		14.22±0.05	13.84±0.04	13.32±0.03
		94/06/19	523.451	14.68±0.09	14.12±0.05	13.64±0.05	13.15±0.04
		94/06/20	524.444	14.35±0.14	14.14±0.05	13.58±0.04	
		94/06/22	526.383	14.56±0.09	14.10±0.05	13.64±0.04	13.16±0.03
		94/06/24	528.436	12.42±0.09	12.28±0.06	12.24±0.04	
		94/06/30	534.385	14.54±0.07	13.92±0.05	13.55±0.04	13.17±0.04

Table 1: (continued)

Name	Type	Date UT	JD (2449000+)	B	V	R_C	I_C
PR Her	UG	95/06/30	899.398			15.17±0.08	
V611 Her	UG	95/06/30	899.367			16.8±0.3	
V632 Her	UG	95/06/30	899.437			16.4±0.2	
T Leo	SU	95/02/02	750.628		15.95±0.09	15.81±0.09	15.22±0.07
RZ LMi	UG	95/02/02	750.568		15.16±0.08	15.04±0.06	14.95±0.04
IR Lyr	UG	95/06/30	899.553			15.19±0.08	
V415 Lyr	UG:	95/06/30	899.598			16.5±0.2	
V419 Lyr	ZC	95/06/30	899.588			15.43±0.08	
BI Ori	UG	94/12/01	729.481			16.2±0.1	
		95/01/16	733.431		15.69±0.06	15.56±0.05	15.27±0.06
CZ Ori	UG	93/01/27	043.462	13.74±0.08	13.38±0.05	13.69±0.03	
		94/01/12	394.491		14.65±0.08		
		94/01/18	400.455		15.07±0.09		
		94/10/14	640.538			16.1±0.1	
		94/10/22	649.508		12.87±0.05		
		94/10/27	654.494		15.99±0.08	15.52±0.05	14.59±0.05
		94/11/17	675.589		15.46±0.07	15.21±0.05	14.53±0.05
		94/12/02	690.403	13.14±0.08	13.19±0.05	13.06±0.05	12.77±0.05
		95/01/12	729.461	15.11±0.09	15.28±0.05	15.02±0.05	14.35±0.05
		95/01/16	733.329			15.75±0.07	
		95/02/02	750.399	16.3 ±0.2	15.99±0.08	15.52±0.05	14.35±0.05
		95/09/27	988.981	13.39±0.06	13.43±0.05	13.33±0.05	13.04±0.05
		95/09/29	990.931	14.52±0.07	14.65±0.05	14.39±0.05	13.87±0.05
		96/12/03	1421.565		15.89±0.07	15.39±0.04	14.69±0.04
		96/12/04	1422.417		15.74±0.06	15.29±0.04	14.42±0.04
		96/12/05	1423.437		15.57±0.05	15.13±0.04	14.51±0.04
RU Peg	UG	94/10/18	644.365		12.65±0.05		
KT Per	ZC	94/10/18	644.396		14.71±0.05		
NS Per	UG	95/09/27	988.933			17.2±0.3	
PU Per	UG	95/09/29	990.859			17.1±0.3	
PY Per	ZC	95/01/12	729.431	14.09±0.08	14.01±0.06	14.21±0.06	13.56±0.06
		95/01/16	733.254		15.18±0.09	15.07±0.06	14.88±0.06
		95/09/27	988.923			16.1±0.2	
TZ Per	ZC	94/10/13	639.569			14.29±0.05	
		94/10/18	644.415	13.43±0.07	13.22±0.05	12.97±0.05	12.74±0.05
		94/10/18	644.536	13.45±0.06	13.17±0.05	12.98±0.05	12.77±0.05
		95/01/16	733.345	12.93±0.06	12.61±0.05	12.58±0.05	12.28±0.05
FY Vul	ZC	95/08/23	953.298	14.24±0.08	13.99±0.05	13.71±0.05	13.43±0.05

Table 2: The spectral slope of some Dwarf Novae

Name	Type	JD(2449000+)	α
RX And	ZC	662.426	0.4±0.1
YZ Cnc	SU	729.621	0.9±0.1
V516 Cyg	UG	1694.421	0.4±0.1
V1028 Cyg	UG	932.465	0.9±0.2
AH Her	ZC	473.466	0.2±0.1
CZ Ori	UG	690.403	0.3±0.2

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INFRARED LIGHT CURVES OF THE BINARY SYSTEM HY Vir

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HY Vir (SAO 139174, HD 114125, BD $-1°2777$) was firstly discovered as a variable star by Rodríguez *et al.* (1988). Later Casas and Gómez–Forrellad (1989) confirmed that HY Vir is a detached eclipsing binary from observations carried out at Observatorio del Teide (Canary Islands, Spain) in the V band. They also gave the first ephemeris. This ephemeris and the original physical elements were improved from new observations (V band) of HY Vir during several nights in April 1995 using the 0.4–m telescope at Observatorio de Mollet (Spain) (García–Melendo *et al.* 1995). The new calculated ephemeris suggests a shorter period for HY Vir, but they claimed for more timings of minima in order to discern whether it was due to a lack of accuracy in the initial period estimate or real period changes. The combined spectrum of HY Vir is F2 V (SAO Catalogue). In the Hipparcos archive HY Vir is identified as a chemically peculiar variable at a distance of about 120 pc. (Paunzen and Maitzen, 1998). Strömgren indices are given in Hauk and Mermilliod (1998).

The observations presented in this paper were performed during 12 nights over the period 26 April to 13 May 1999, with the 1.5 m Carlos Sanchez Telescope at the Observatorio del Teide (Canary Islands, Spain) (Table 1). We used a CVF photometer with a focal plane chopper, an InSb detector cooled with liquid nitrogen and standard broadband J, H and K filters. Both the chopping amplitudes and the aperture diameter were 15. The estimated photometric errors were less than 0.01 mag. More than 550 observations were obtained in each band. The main comparison star was SAO 139131 (48 Vir). Orbital phases were calculated using the ephemeris given by García–Melendo *et al.* (1995): HJD Min.I = $2447240.97128 + 2\overset{d}{.}73236 \times E$.

From the published Strömgren indices at the maxima, using the relations of Grøsbol (1978), we derive a mean effective temperature $T_{\rm eff} \approx 6900$ K for HY Vir. The colour indices $(V-J)$=$0\overset{m}{.}73$, $(V-H)$=$0\overset{m}{.}85$ and $(V-K)$=$0\overset{m}{.}93$ in the maxima are in agreement with Johnson (1966) and Koornneef (1983) colour index– spectral type determinations of F2 V stars.

In order to determine new geometrical elements from our IR light curves, we used the code developed by Budding & Zeilik (1987). The program, based on the Information Limit Optimization Technique (ILOT), takes into account ellipticity, gravity darkening and reflection effects, and gives equivalent spherical radii to describe the sizes of the distorted stellar components. It has been shown that this code produces geometrical parameters in good agreement with those derived using other existing light–curve fitting codes even for contact binaries (see Banks 1993 and references therein). A circular orbit was assumed, as emerged from the duration and orbital phases of both eclipses. The limb darkening coefficients were interpolated from the values given by Claret, Díaz–Cordovés & Giménez (1995).

Light curve elements have been computed from the V observations using the EBOP code by Giménez and Casas (1990) and later by García–Melendo *et al.* (1995). From these works the overall picture of HY Vir is a detached binary with similar spectral type components. In fact García–Melendo *et al.* determined a mass ratio $q = m_2/m_1$=0.95, T_1=7200 K and T_2=6900 K supposing very different radii values with $k = r_2/r_1 \approx 0.60$. With these values as initial set of parameters different fits were performed to our J, H and K light curves. The radii ratio $k = r_2/r_1$ has been varied from 0.50 to 1.15.

Our IR light curve analysis yields values in agreement with the published V light curve determinations, except the ratio $k = r_2/r_1$. But the solution with smaller χ^2 in the three J , H and K fits, gives a final $k = r_2/r_1 \approx 0.85$ pointing to a larger secondary star. Tables 2 and 3 gives the resulting parameters of both solutions and in Figure 1 the synthetic light curves with $k = r_2/r_1 \approx 0.85$ are plotted together with the observations. As a future work, spectroscopic observations and radial velocity curves are necessary in order to give a definitive determination of the physical parameters of this new bright binary.

Table 1: Observing run

Observation date	Observed Filters
27–28 April 1999	H,K
28–29 April 1999	J,H,K
1–2 May 1999	J,H,K
2–3 May 1999	J,H,K
3–4 May 1999	J,H,K
4–5 May 1999	J,H,K
5–6 May 1999	J,H,K
6–7 May 1999	J,H,K
7–8 May 1999	J,H,K
8–9 May 1999	J,H,K
9–10 May 1999	J,H,K
9–11 May 1999	J,H,K

Table 2: *ILOT* light curves solutions

	J filter	H filter	K filter
L_1	0.721 ± 0.002	0.672 ±0.002	0.675 ±0.002
L_2	0.279 ± 0.002	0.328 ± 0.002	0.325 ± 0.002
r_1	0.201 ± 0.001	0.211± 0.001	0.208± 0.001
r_2	0.141 ± 0.001	0.147 ± 0.001	0.148 ± 0.001
k	0.70	0.70	0.71
i	79°.9± 0°.1	80°.7± 0°.1	79°.7± 0°.1
χ^2	286	376	439
ϵ	0.01	0.01	0.01
N.Points	564	589	586

Table 3: *ILOT* light curves solutions

	J filter	H filter	K filter
L_1	0.581 ± 0.002	0.579 ±0.002	0.581 ±0.002
L_2	0.419 ± 0.002	0.421 ± 0.002	0.419 ± 0.002
r_1	0.191 ± 0.001	0.192± 0.001	0.190± 0.001
r_2	0.164 ± 0.001	0.165 ± 0.001	0.162 ± 0.001
k	0.86	0.86	0.85
i	$79^\circ\!.6 \pm 0^\circ\!.1$	$80^\circ\!.1 \pm 0^\circ\!.1$	$79^\circ\!.9 \pm 0^\circ\!.1$
χ^2	263	345	420
ϵ	0.01	0.01	0.01
N.Points	564	589	586

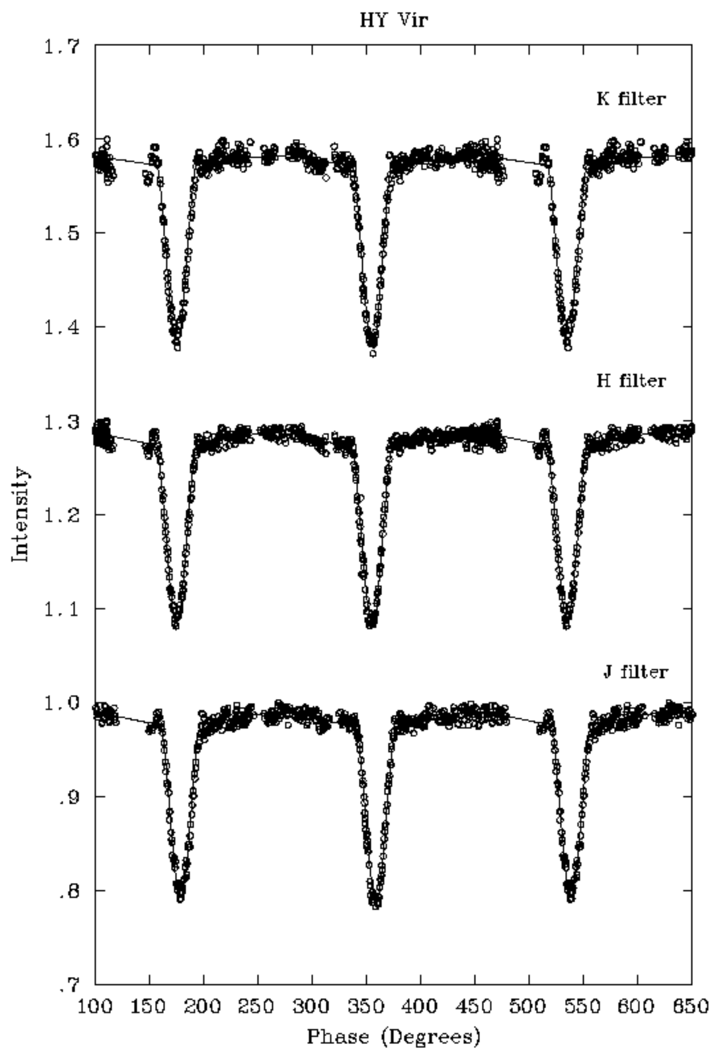

Figure 1. Observed light curves and the fits obtained with *ILOT*. The H and K filter intensities are shifted by $0^m\!.3$ and $0^m\!.6$, respectively.

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VARIABILITY OF GSC 3151.0633

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Name of the object:
GSC 3151.0633

Equatorial coordinates:	**Equinox:**
R.A.= $20^h16^m58\overset{s}{.}8$ **DEC.=** $+39°05'23''$	2000.0

Comparison star(s):	GSC 3151.0480

Check star(s):	GSC 3151.0600 and GSC 3151.0197

Observatory and telescope:
Vyskov observatory, Czech Republic, RL 300/1200 mm telescope

Detector:	CCD camera SBIG ST-7, 382 × 255 pixels, 19′ × 13′ FOV

Filter(s):	unfiltered CCD band and V filter

Transformed to a standard system:	No

Date(s) of the observation(s):
from August 2000 to November 2001

Method of data reduction:
Images were processed by MUNIDOS photometry software package. (Hroch, 1997)

Method of minimum determination:
The times of minima (see table 1) were derived by means of Tintagel programme, based on an artificial neural network (Gaspani, 1995).

Type of variability:	EB

Availability of the data:
Upon request

Ephemeris:			
Star name	E 2400000+	P [day]	Source
GSC 3151.0633	52122.459 ± 0.001	0.50619 ± 0.00001	this paper

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
GSC 3151.0633	52027.5476	0.0010	sec.	C	0.001	H, K
	52030.5819	0.0006	sec.	C	−0.004	H, K
	52042.4863	0.0011	prim.	C	0.005	K
	52121.4521	0.0016	prim.	V	0.006	K
	52122.4612	0.0011	prim.	C	0.002	K
	52127.5131	0.0018	prim.	V	−0.008	K
	52195.3495	0.0038	prim.	V	0.001	H, M

Explanation of the remarks in the table:
Observer: H=Hajek, K=Koss, M=Motl

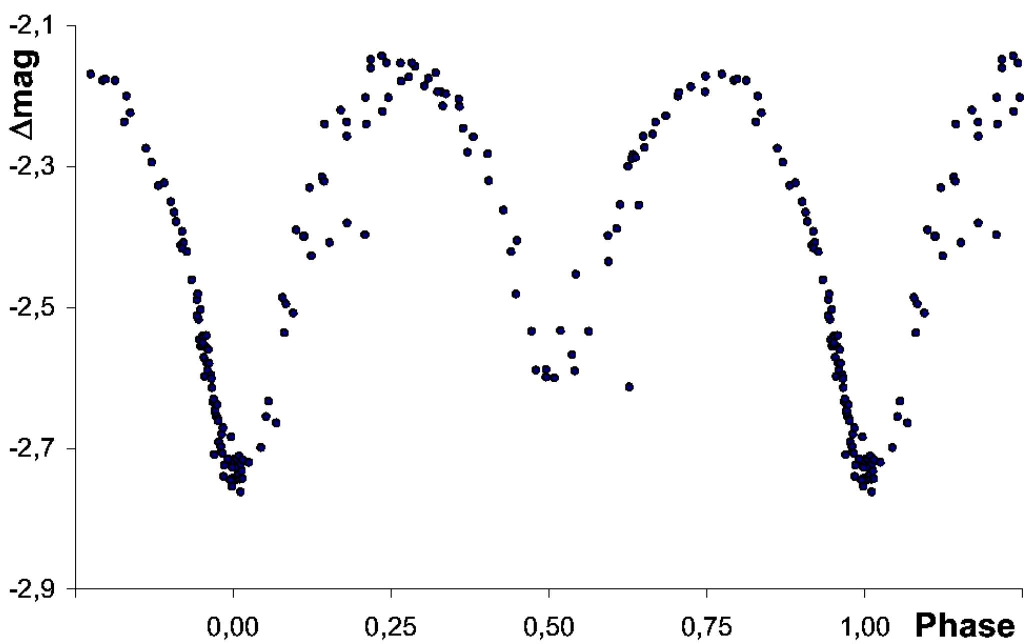

Figure 1. Folded light curve of GSC 3151.0633.

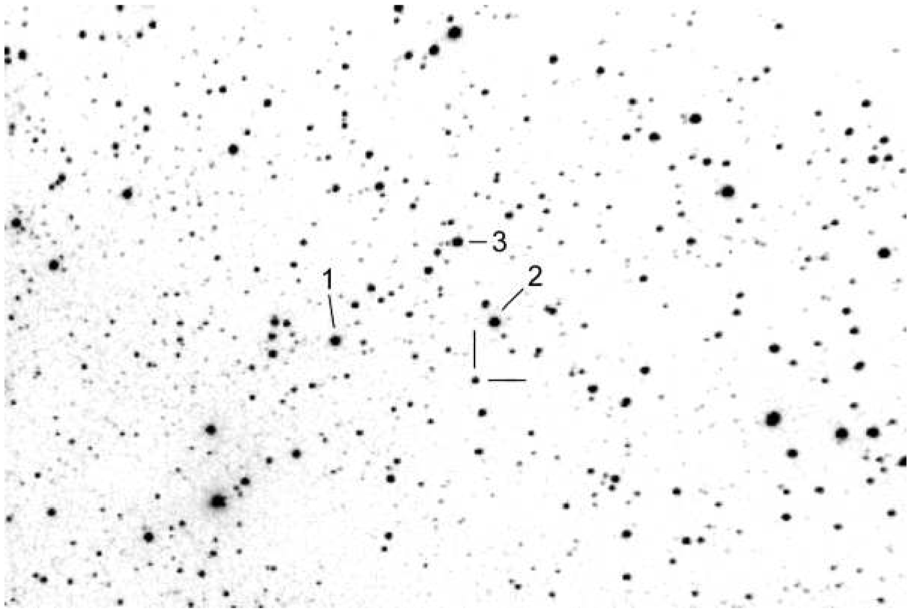

Figure 2. Identification map of GSC 3151.0633 (bars), comparison star (No. 1) and two check stars (No. 2 and 3). The size of the field is 19 × 13 arc minutes, unfiltered CCD band, 20-second exposure.

Remarks:
The authors discovered light changes of GSC 3151.0633 on CCD frames which were taken on August 7/8, 2000 at the observatory in Vyškov (a station of N. Copernicus Observatory and Planetarium Brno) when monitoring V699 Cyg (Whitney, 1952). The light curve elements were determined with the help of our Varplot application. Figure 1 displays the folded light curve. Magnitudes are instrumental and they are relative to the comparison star used. The depth of the primary and secondary minima are $0\overset{m}{.}5$ and $0\overset{m}{.}6$, respectively. Figure 2 shows one CCD frame (20-second exposure, unfiltered CCD band) with the identification of a variable (bars), the comparison star used (No. 1, GSC 3151.0480) and two check stars (No. 2 and 3 and GSC 3151.0197).

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UNUSUAL OUTBURSTING STATE OF A Z Cam-TYPE STAR HL CMa

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HL CMa is well known dwarf nova which was discovered as an Einstein X-ray source (Fuhrmann 1980; Chlebowski et al. 1981; Bailey et al. 1981; Meinunger 1981). Although the possible Z Cam-type nature had long been suggested (cf. Mansperger et al. 1994), the exact classification of the object required more than a decade until the detection of an unmistakable long standstill in 1999 (Watanabe et al. 2000). Several authors reported relatively unusual spectroscopic features in HL CMa (e.g. Wargau et al. 1983). Although later observations could not confirm the result (Cropper 1986), there was even a claim of the possible presence of circular polarization (Chlebowski et al. 1981). The object was thus intensively observed, particularly in the ultraviolet (Bonnet-Bidaud et al. 1982; Mauche, Raymond 1987a,b), which revealed the presence of significant outflow. Still et al. (1999) further studied the system, and obtained an orbital period of $0^{\mathrm{d}}.2146$ or $0^{\mathrm{d}}.2212$. In spite of the relatively rich observations in the past, no spectroscopic observation during standstills has been reported, presumably because of the rarity of standstills.

The typical outburst cycle length of HL CMa is 15^{d} (cf. Chlebowski et al. 1981; see also Figure 1). During standstills, this outburst pattern disappears (Figure 2) as in other Z Cam stars (cf. Warner 1995).

In 2001–2002, we noticed the presence of "the third" outbursting state (Figure 3). During this period, the star showed weak ($\sim 1^{\mathrm{m}}$) outbursts with a longer ($\sim 30^{\mathrm{d}}$) outburst cycle length. The outburst amplitude was intermediate between that of normally outbursting state (Figure 1) and nearly zero during standstills (Figure 2). Although the decrease of the outburst amplitude could be a result of an increased mass-transfer rate, the lengthening of the cycle length is quite unexpected, because an increase of mass-transfer rate generally leads to a shortening of the cycle length (e.g. Cannizzo et al. 1988, in which HL CMa was listed as an object already close to the instability border).

Such behavior may be compared to an unusually slow fading of a standstill in another Z Cam-type star AT Cnc (Kato et al. 2001). Kato et al. (2001) proposed that this behavior may be a combined result of heating on the accretion disk at an accretion rate slightly below the stability, analogous to fadings of VY Scl-type stars (Leach et al. 1999). The presence of strong P Cyg feature in the ultraviolet (Bonnet-Bidaud et al. 1982; Mauche, Raymond 1987a) and the unusual presence of high-excitation optical lines (Wargau et al. 1983; Chlebowski et al. 1981) could be interpreted as an emerging signature of strong irradiation field. Since there have been only few occasions of unusually outbursting states in the decades-long history, X-ray and spectroscopic observations to detect further signatures of high-energy photons and irradiation are highly encouraged during the present unusual state.

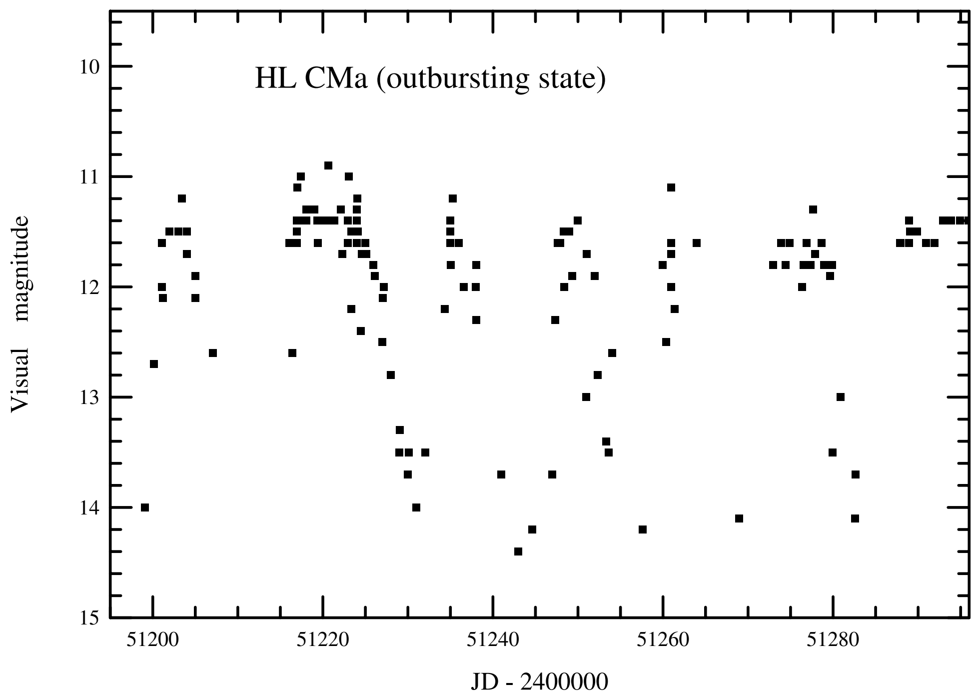

Figure 1. HL CMa in normally outbursting state. The data are from visual observations reported to VSNET (`http://www.kusastro.kyoto-u.ac.jp/vsnet/`). The errors of visual observations are usually less than $0\overset{m}{.}5$, which do not affect the discussion. Outbursts recur every $\sim 15^{d}$.

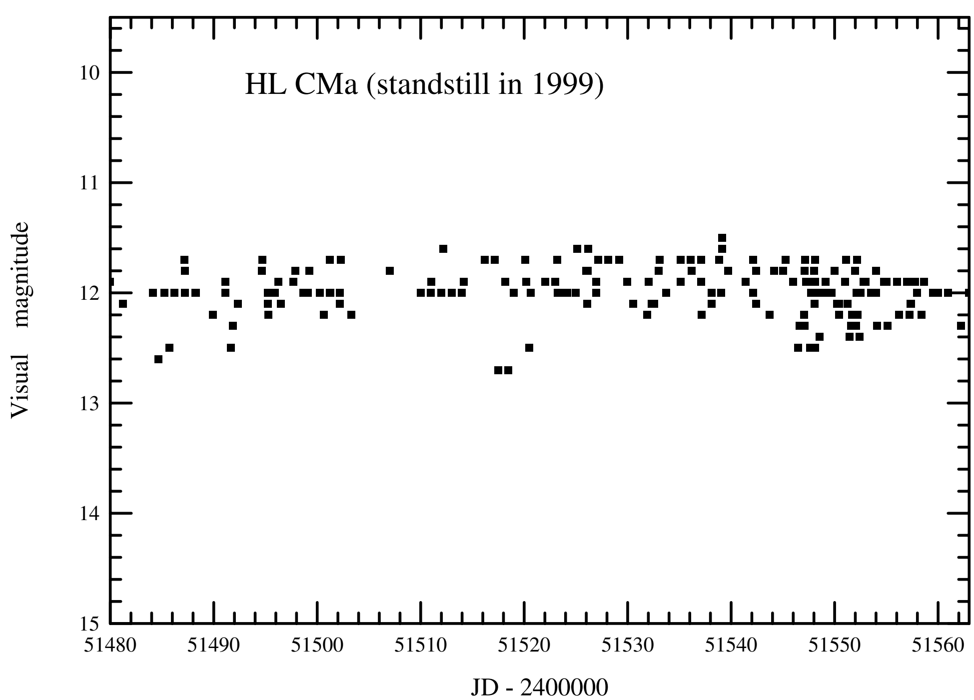

Figure 2. Representative light curve of the standstill of HL CMa in 1999 (data from VSNET). The star stopped outbursting.

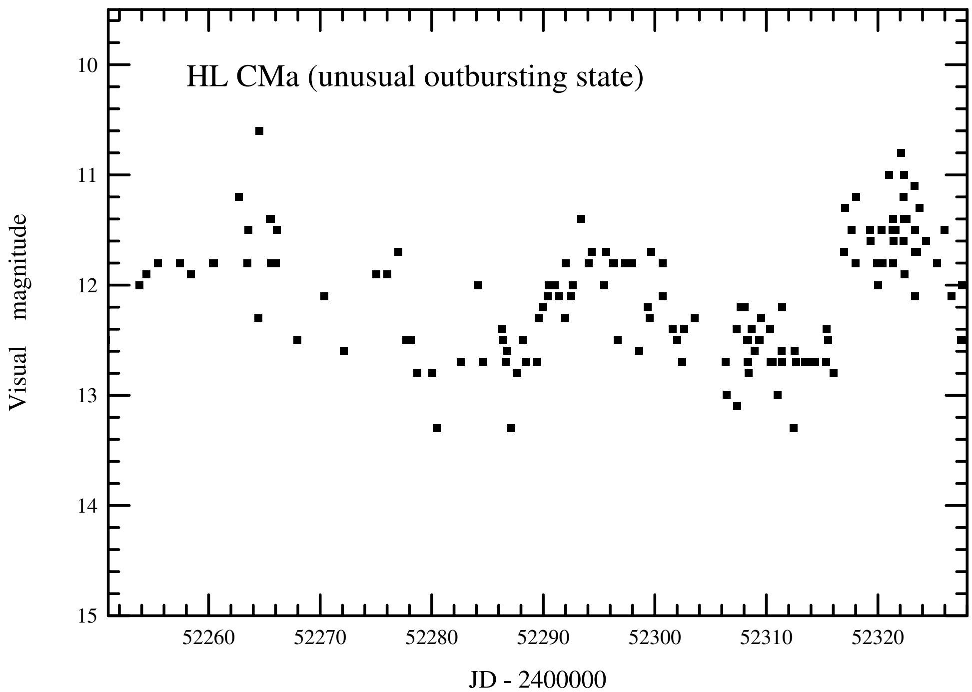

Figure 3. Light curve of the "third state" of HL CMa in 2001–2002. The star showed weak ($\sim 1^{\rm m}$) outbursts with a longer ($\sim 30^{\rm d}$) outburst cycle length.

We are grateful to many VSNET observers who have reported vital observations. This work is partly supported by a grant-in aid (13640239) from the Japanese Ministry of Education, Culture, Sports, Science and Technology.

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HD 275525, GSC 02866-01866 AND GSC 03429-01645 : THREE NEW DELTA SCUTI TYPE VARIABLES

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Observatory and telescope:
Sobaeksan Optical Astronomy Observatory, 61cm telescope

Detector:	SITe 2K CCD camera (FOV 20′.5×20′.5)

Filter(s):	*B*, *V*

Transformed to a standard system:	No

Availability of the data:
Upon request

Method of data reduction:
Standard CCD-frame reduction using the IRAF package[1]

Observed star(s):				
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp./check star(s)
HD 275525	DSCT	3 37 15.0	+40 54 00	HD 275605/GSC 02866-01819
GSC 02866-01866	DSCT	3 36 54.4	+40 55 40	HD 275605/GSC 02866-01819
GSC 03429-01645	DSCT	9 32 45.7	+49 38 06	GSC 03429-00621/GSC 03429-01027

[1]IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

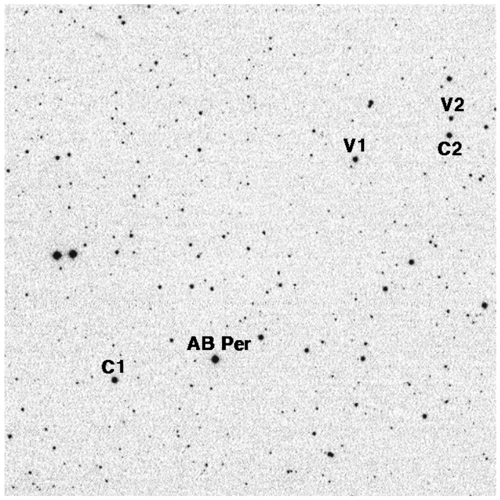

Figure 1. An observed CCD image (20.′5×20.′5) near the eclipsing binary AB Per. Two new variable stars (V1 = HD 275525 and V2 = GSC 02866-01866) and two comparison stars (C1 = HD 275605 and C2 = GSC 02866-01819) are marked. North is up and east is to the left

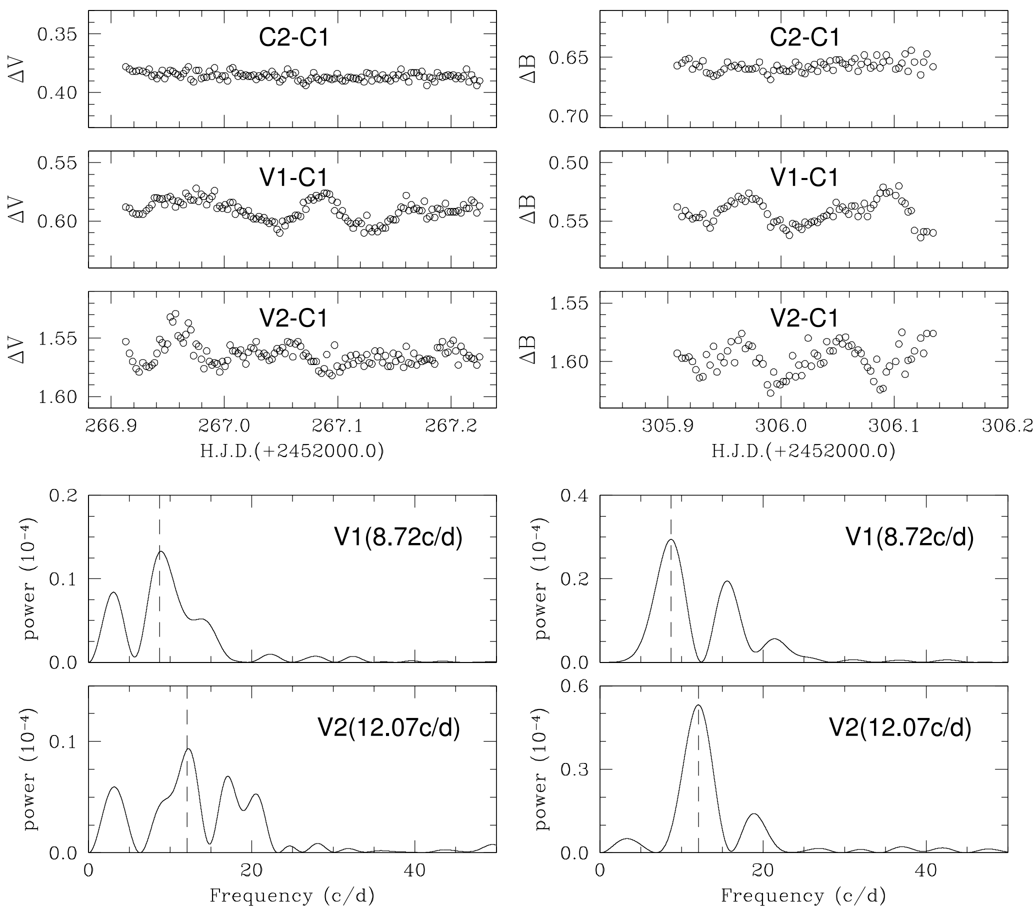

Figure 2. Light curves (upper) and its power spectra (lower) of two variable stars discovered in the observed field of AB Per. The dominant frequency (vertical dashed line) is about 8.72 c/d for HD 275525 and about 12.07 c/d for GSC 02866-01866, respectively. Magnitude differences between comparison star (C1) and check star (C2) are plotted in the top panel

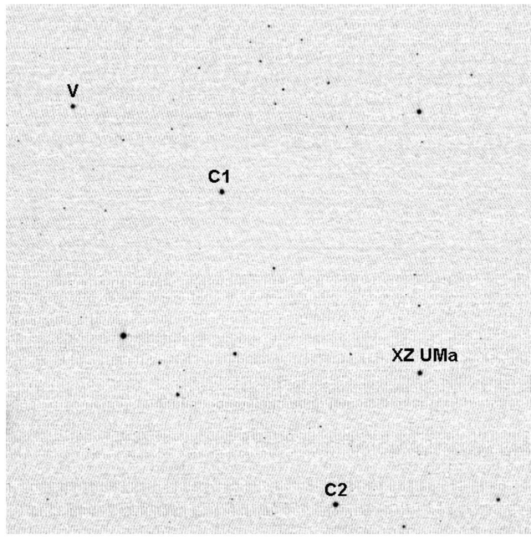

Figure 3. An observed CCD image (20.′5×20.′5) near the eclipsing binary XZ UMa. A new variable star (V = GSC 03429-01645) and two comparison stars (C1 = GSC 03429-00621 and C2 = GSC 03429-01027) are marked. North is up and east is to the left

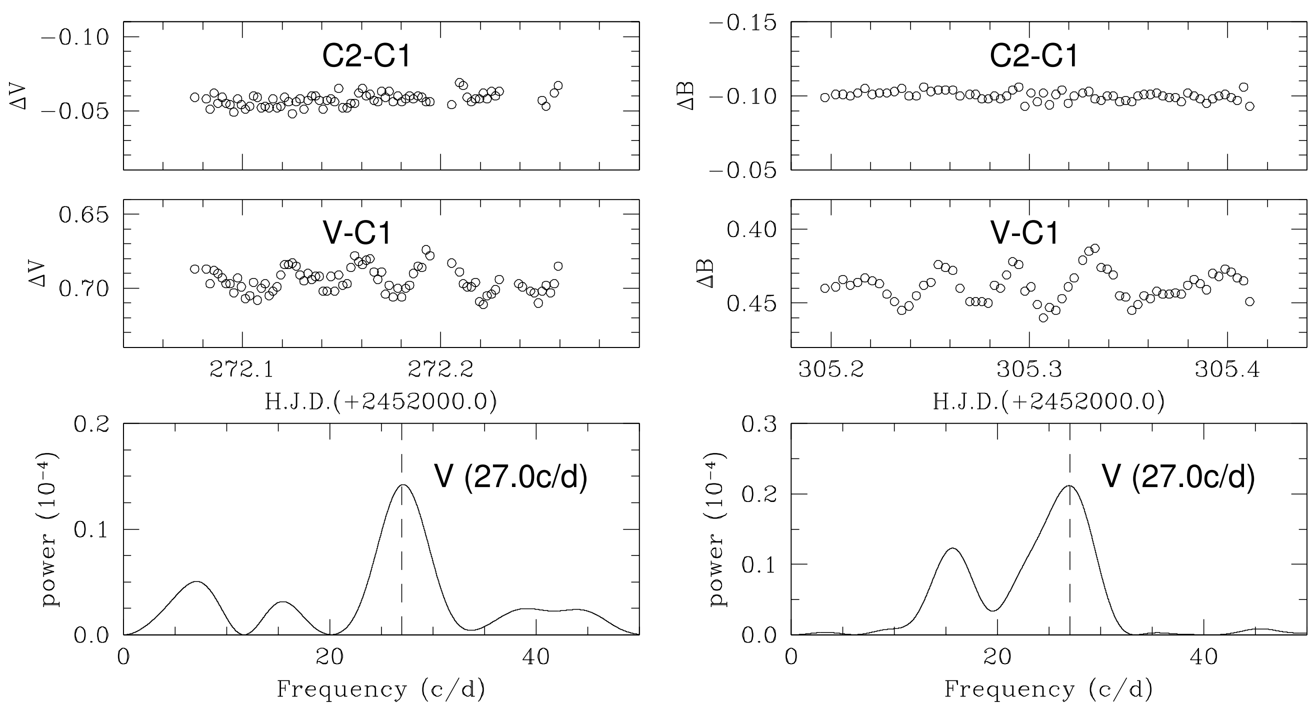

Figure 4. Light curves (upper) and its power spectra (lower) of a variable star discovered in the observed field of XZ UMa. A dominant frequency is shown at about 27.0 c/d (vertical dashed line). Magnitude differences between comparison star (C1) and check star (C2) are plotted in the top panel

Remarks:

As a part of the observational survey to search for δ Scuti type pulsating components in eclipsing binary systems (Kim et al. 2002), we performed time-series CCD observations of AB Per and XZ UMa in December 23 and 28, 2001 with V filter. After reducing the data, we have discovered serendipitously three new variable stars in the observed fields. To confirm this variability, we obtained again time-series CCD frames in January 30 and 31, 2002 with B filter. We applied classical two-star differential photometry to get differential magnitudes and derived variable periods from the discrete Fourier analysis (Scargle 1989).
Maximum amplitudes are about $0\overset{m}{.}03$ in V-band and $0\overset{m}{.}04$ in B-band for HD 275525, about $0\overset{m}{.}04$ in V-band and $0\overset{m}{.}05$ in B-band for GSC 02866-01866 and about $0\overset{m}{.}03$ in V-band and $0\overset{m}{.}04$ in B-band for GSC 03429-01645. Light variations show smooth and very complicated curves, indicating that multiple periods are superimposed. The dominant frequency for each variable star is about 8.72 c/d ($0\overset{d}{.}115$) for HD 275525, about 12.07 c/d ($0\overset{d}{.}083$) for GSC 02866-01866 and about 27.0 c/d ($0\overset{d}{.}037$) for GSC 03429-01645, respectively. Considering the above variable characteristics, we suggest that the three variable stars can be identified as δ Scuti type pulsating variables.

Acknowledgements:

This research made use of the SIMBAD database, operated at CDS, Strasbourg, France

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MINIMA OF SV Cam FROM JANUARY 2001 - FEBRUARY 2002

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Astronomical Institute, Tatranská Lomnica, 059 60, Slovakia; e-mail: zboril@astro.sk

Observatory and telescope:
0.6m telescopes at Skalnaté Pleso (SP) and Stará Lesná (SL) observatories

Detector:	Photometers: OPTEC SSP-5, HAMAMATSU R4457 and EMI 9789 Q photomultipliers.

Method of data reduction:
3×S−3×V−3×CH sequence plus sky background records corrected for differential extinction.

Method of minimum determination:
The minima times were computed with parabolic fitting, center of gravity, Kwee & van Woerden (1956), bisectors; software Komžík (2002).

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
SV Cam	RS	06 41 19	+82 16 02	SAO 1045 SAO 1030	49350.3037	0.593071	1.

Source(s) of the ephemeris:
1.: Pojmański (1988)

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
SV Cam	51952.434	9	II	B,V,R	0.031	SP
	52043.449	1	I	–	0.009	SP
	52044.336	9	II	B,V	0.007	SL
	52054.418	2	II	B,V,R	0.007	SP
	52198.237	2	I	–	0.005	SP
	52208.321	1	I	–	0.007	SP
	52310.636	5	II	V,R	0.018	SP
	52321.598	1	I	B,V,R	0.008	SP
	52321.305	5	II	–	0.012	SP

Acknowledgements:
The work was supported by the grant No. 2/1024/21 of Slovak Grant Agency for Science. The support of AIP Potsdam is gratefully acknowledged.

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Pojmański, G., 1998, *Acta. Astron.*, **48**, 711

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MISSED NOVA AQUILAE 1985 ON MOSCOW AND SONNEBERG PLATES

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In the course of the search for new variable stars on the plates of Moscow collection, an unknown star with outburst-type variability was discovered by one of the authors (S. Antipin). But only the common effort using both the Moscow and Sonneberg plate archives allowed us to investigate the new variable carefully and to classify the star as a missed nova.

The star was estimated by eye on the plates taken with the 40-cm astrograph in Crimea and on the Sonneberg Sky Patrol plates taken in two colours (*pg* and *pv*) with the 55/250-mm short-focus cameras. Unfortunately, only four plates with the newly discovered Nova Aql 1985 seen were obtained in Crimea between September 1984 and June 1986. So, the absolute majority of data were obtained thanks to Sonneberg Sky Patrol.

The results of our research are given in Table 1. The Sonneberg estimates are marked by "S", and the Moscow ones by "M" in the last column of the table. Uncertain and very uncertain estimates are labeled with a colon and with two colons respectively. In addition, CCD observations with the 60-cm reflector in Crimea were carried out to obtain B and V magnitudes of the comparison stars (Table 2). We used magnitudes of stars near V1343 Aql (Leibowitz and Mendelson, 1982) as a photoelectric standard. The last star in Table 2 is not included in the Guide Star Catalogue but it is in the USNO-A2.0 catalogue, at the coordinates $\alpha = 19^{\rm h}02^{\rm m}24\overset{\rm s}{.}27$, $\delta = +13^\circ09'54\overset{''}{.}1$ (J2000.0).

The light curve of the nova outburst in blue light is given in Fig. 1. The filled circles, open circles and triangles represent photographic observations, uncertain estimates and the upper limits (for negative observations) based upon Sonneberg plates, filled squares show the four Moscow estimates. The nova's maximum was reached on JD2446266 (July 19, 1985) and its brightness was 10.63*pg* and 9.65*pv* with an error of about ±0.10 mag. The rate of the brightness decrease shows that the star belongs to the fast novae (NA). The brightness level 3 magnitudes fainter that the maximum one was reached in about 80 days after the outburst.

We used possibilities of USNOFS Image and Catalogue Archive

`http://www.nofs.navy.mil/data/FchPix/`

to check the position of the nova on POSS I and II plates (Fig. 2). There is no star at the nova's position on POSS I red and blue plates (Fig. 2ab, epoch 1952.615). But

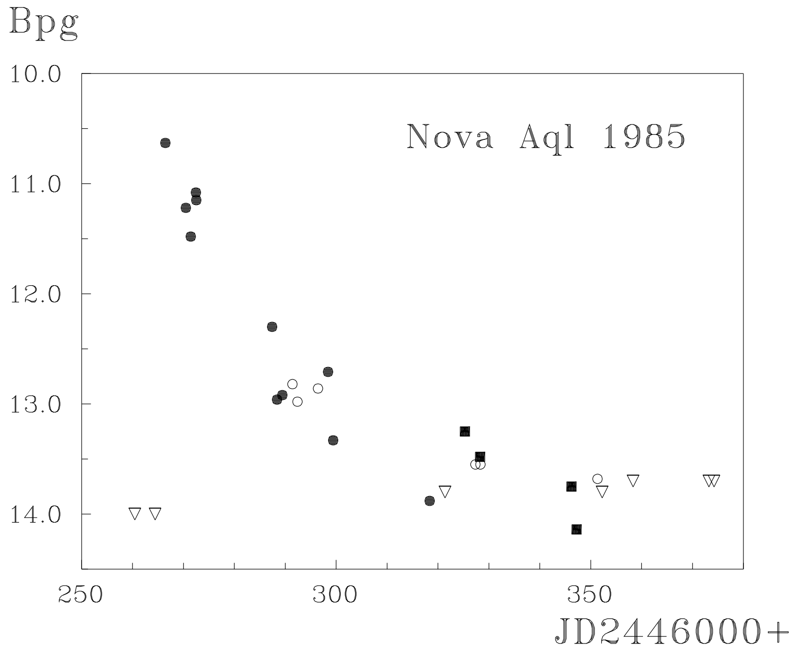

Figure 1. The photographic light curve of the nova outburst. See the text for explanations of the symbols.

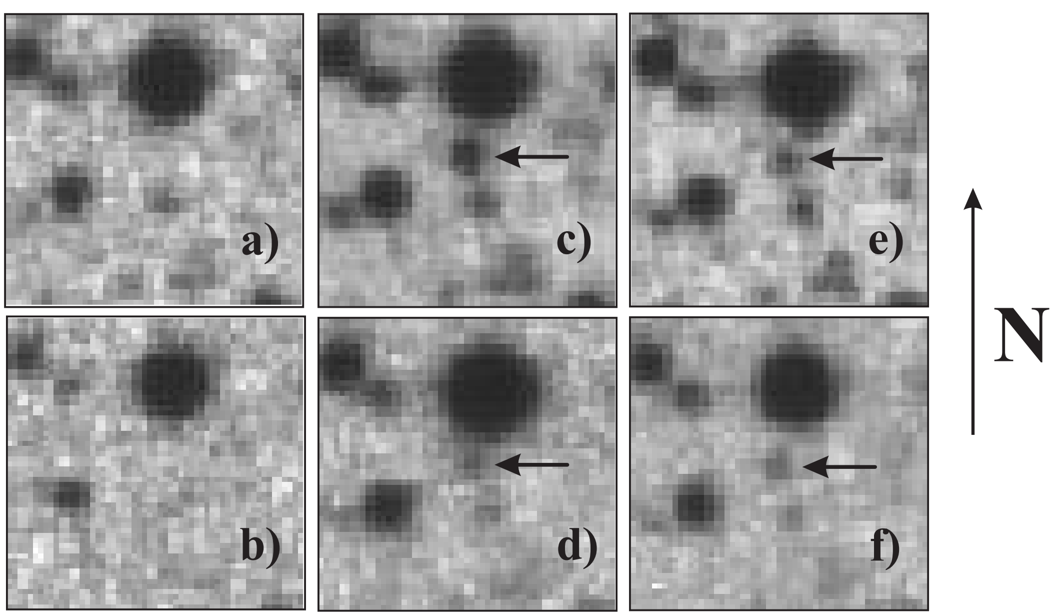

Figure 2. The field of Nova Aql 1985 on POSS images. The size of charts is $0.'5 \times 0.'5$. a) POSS I red, epoch 1952.615. b) POSS I blue, epoch 1952.615. c) POSS II red, epoch 1987.410. d) POSS II blue, epoch 1990.474. e) POSS II red, epoch 1990.627. f) POSS II blue, epoch 1990.539. The post-nova is marked by arrow.

Table 1: Observations of Nova Aql 1985

JD 2 446 000+	pg	pv	Obs.	JD 2 446 000+	pg	pv	Obs.
200.521	[13.8	–	S	318.370	13.88	12.38	S
260.456	[14.0	–	S	320.331	[13.0	–	S
264.433	[14.0	–	S	321.381	[13.8	–	S
266.457	10.63	9.65	S	325.281	13.25	–	M
270.467	11.22	9.85	S	327.346	13.55 :	12.36 :	S
271.429	11.48	–	S	328.253	13.48	–	M
272.463	11.08	9.67	S	328.345	13.55 :	12.31 :	S
272.503	11.15	–	S	346.236	13.75	–	M
287.426	12.30	–	S	347.244	14.14	–	M
288.404	12.96	12.22	S	351.335	13.68 :	12.33 :	S
289.399	12.92	–	S	352.279	[13.8	–	S
291.407	12.82 :	12.31 ::	S	358.319	[13.7	–	S
292.402	12.98 :	12.27 :	S	373.229	[13.7	–	S
296.434	12.86 ::	–	S	374.240	[13.7	–	S
298.409	12.71	–	S	385.240	[13.7	–	S
299.420	13.33	12.32 :	S	386.227	[13.7	–	S

the post-nova is clearly present on POSS II red (Fig. 2ce, epochs 1987.410 and 1990.627) and blue (Fig. 2df, epochs 1990.474 and 1990.539) images taken several years after the outburst. Brightness of Nova Aql 1985 were measured on POSS II red (Fig. 2e) and blue (Fig. 2d) plates using red and blue magnitudes of neighbouring stars from the USNO-A2.0 catalogue for comparison. The resulting magnitudes are:

$$r = 18.6 \pm 0.2,\ \mathrm{JD2448121};\quad b = 20.0 \pm 0.2,\ \mathrm{JD2448065}.$$

Using the positions of stars from the USNO-A2.0 catalogue, we derived the accurate coordinates of the nova from the plate of Moscow archive (taken on JD2446325.281) and from the POSS II images. They are the following:
$\alpha = 19^{\rm h}02^{\rm m}14^{\rm s}.45\ (\pm 0^{\rm s}.04)$, $\delta = +13^\circ 03' 04''.4\ (\pm 0''.6)$, (J2000.0), on Moscow plate;
$\alpha = 19^{\rm h}02^{\rm m}14^{\rm s}.50\ (\pm 0^{\rm s}.01)$, $\delta = +13^\circ 03' 03''.9\ (\pm 0''.2)$, (J2000.0), average of POSS II images taken in 1990. So, the position of nova in outburst is in good agreement with coordinates of the star that we identified as a post-nova.

Finally, note that the post-nova can be found in the GSC 2.2.01 as a 17.24 ± 0.44 (red magnitude) object at the coordinates $\alpha = 19^{\rm h}02^{\rm m}14^{\rm s}.484\ (\pm 0''.4)$, $\delta = +13^\circ 03' 03''.22\ (\pm 0''.4)$, (J2000.0), epoch 1987.412. Small deviation in the coordinates of the nova measured by us and those from the GSC 2.2 could be explained by different astrometrical systems of the GSC 2.2 and the USNO-A2.0 catalogues.

The authors would like to thank Dr. N.N. Samus for his help and useful discussion. S. Antipin and S. Shugarov are grateful to the Russian Foundation for Basic Research (grant No. 02-02-16462) and the Council of the Program for the Support of Leading Scientific Schools (grants Nos. 00-15-96627 and 00-15-96553) for partial support of this research. The study was supported in part through Russian Universities grant No. 5558 for one of the authors (S. Shugarov).

Table 2: Comparison stars

GSC	B	V
1048.1691	10.07	9.71
1048.1465	10.75	10.30
1048.1591	11.10	9.55
1047.0749	11.35	10.77
1052.1026	11.71	11.12
1048.0076	12.26	11.13
1048.0106	12.86	12.24
1048.1625	12.94	12.31
1048.1775	13.02	12.38
1048.0223	13.68	12.94
1052.0042	14.05	13.30
USNO-A2.0 0975.13938259	14.62	13.55

Reference:

Leibowitz, E.M., Mendelson, H., 1982, *PASP*, **94**, 977.

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A NEW SHORT PERIOD VARIABLE STAR IN CYGNUS

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Name of the object:
GSC 3948:1963

Equatorial coordinates:	**Equinox:**
R.A.= $20^{h}03^{m}04\overset{s}{.}3$ **DEC.=** $+59°06'54\overset{''}{.}0$	2000

Observatory and telescope:
Kitt Peak National Observatory, 0.9m telescope

Detector:	T2KA CCD, 2048 × 2048 pixels

Filter(s):	B

Date(s) of the observation(s):
1998.07.10, 11, 28, 30, 31

Comparison star(s):	large ensemble

Check star(s):	large ensemble

Transformed to a standard system:	No

Availability of the data:
upon request

Type of variability:	DSCT

Remarks:
Period of 0.05589 ± 0.00001 days with an amplitude of about 0.14 ± 0.01 mag in B. The descending branch is steeper than the ascending branch.

Acknowledgements:

These observations were made as part of the Research Experience for Undergraduates (REU) programs at the National Optical Astronomy Observatories (NOAO) and the National Solar Observatories (NSO), both of which were funded by the National Science Foundation. We would like to thank Dr. Nigel Sharp of NOAO, and the participants of the 1998 NOAO and NSO REU programs for their help with the observations; and Dr. Tom Kinman of NOAO for his help with the classification.

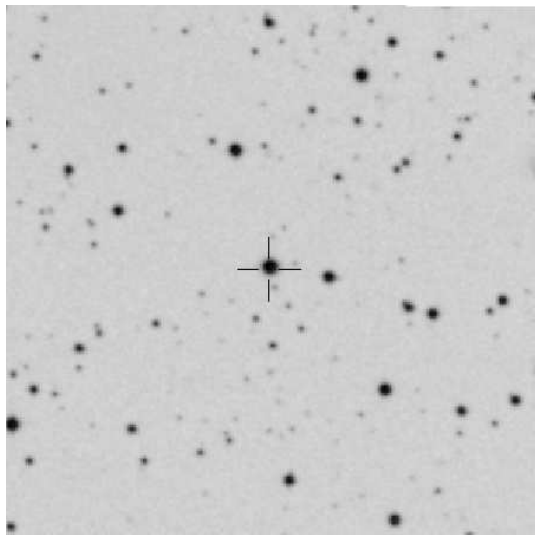

Figure 1. Finding chart for GSC 3948:1963 (5.′0 × 5.′0) from The Digitized Sky Survey. North is up and East is to the left.

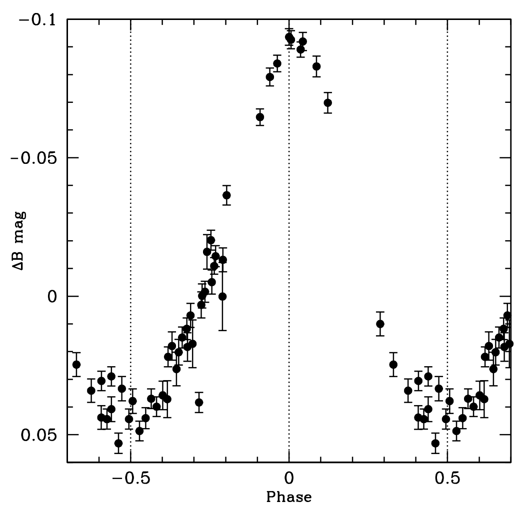

Figure 2. Differential *B* light curve for GSC 3948:1963 using a period of 0.05589 days (1.34136 hours).

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ON THE PERIOD OF THE HIGH AMPLITUDE δ SCUTI VARIABLE DW Psc†

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The star DW Psc (=GSC 614-01209; $\alpha_{2000} = 01^{\rm h}30^{\rm m}26\overset{\rm s}{.}9$; $\delta_{2000} = +08^\circ 41' 34''$) was discovered by Krugly (1999) as a new δ Scuti variable with a period of $0\overset{\rm d}{.}05875$ in the magnitude range $13\overset{\rm m}{.}7$-$14\overset{\rm m}{.}4$.

It was observed at Beersel Hills Observatory (BHO) on one night in November 1999 and six nights between November 2001 and February 2002. A total of 735 data points were obtained during 14.7 hours of photometry. The instrument used was a 0.4m telescope, equipped with a ST7E CCD camera. No filter was used. The exposure times varied between 60 and 120 seconds. In addition 36 datapoints were obtained during a 2 hour-run in November 2001 at the National Astrophysical Observatory (NAO) at Rohzen, (Bulgaria), with the Photometrics CE200A CCD camera attached to the 2.0m telescope. The exposures were taken in V-light with exposure times between 100 and 150 seconds. All images were reduced with the aperture photometry procedure of the Mira AP software package[1] and darkframed and flatfielded according to standard procedures.

The brightness of the variable was measured with respect to GSC 614-00524, while GSC 614-00592 was used as a check star. Both stars have $\Delta(B-V)= 0\overset{\rm m}{.}39$ with respect to the variable. These instrumental values of $\Delta(B-V)$ were determined at BHO from images in B and V light, using a filterset following Bessel's specifications. The nightly standard deviation of the differences in unfiltered magnitudes between the comparison and the check star measured at BHO, averaged $0\overset{\rm m}{.}03$. At Rozhen Observatory this standard deviation amounted to $0\overset{\rm m}{.}009$.

The following times of maxima have been determined by fitting a third degree polynomial through the data around maximum (the $O-C$ values are listed with respect to the ephemeris derived below):

†Based on observations made at Beersel Hills Observatory (Belgium) and the 2.0m telescope operated by the Institute of Astronomy (Bulgaria)

[1]The Mira AP software is produced by Axiom Research Inc.

JD Hel.	E	$O-C$ [d]	Observer	Instrument
2451498.3283	−12088	−0.0006	PVC	BHO, 0.4m
2451498.3892	−12087	0.0005	PVC	BHO, 0.4m
2452219.3644	0	−0.0001	PVC	BHO, 0.4m
2452223.3618	67	0.0008	PL	NAO, 2.0m
2452223.3618	67	0.0008	PVC	BHO, 0.4m
2452223.4198	68	−0.0009	PL	NAO, 2.0m
2452223.4203	68	−0.0004	PVC	BHO, 0.4m
2452224.2557	82	0.0000	PVC	BHO, 0.4m
2452224.3153	83	−0.0001	PVC	BHO, 0.4m
2452228.3119	150	0.0000	PVC	BHO, 0.4m
2452228.3714	151	−0.0002	PVC	BHO, 0.4m
2452228.4319	152	0.0008	PVC	BHO, 0.4m
2452232.3681	218	0.0001	PVC	BHO, 0.4m
2452308.3007	1491	−0.0003	PVC	BHO, 0.4m
2452308.3601	1492	−0.0005	PVC	BHO, 0.4m

From these maxima, the following ephemeris was derived:

$$\begin{array}{l}\text{Max.} = \text{HJD } 2452219\overset{\text{d}}{.}3645 + 0\overset{\text{d}}{.}05964887 \times E. \\ \qquad\qquad\qquad\qquad \pm 0.0002 \pm 0.00000003\end{array}$$

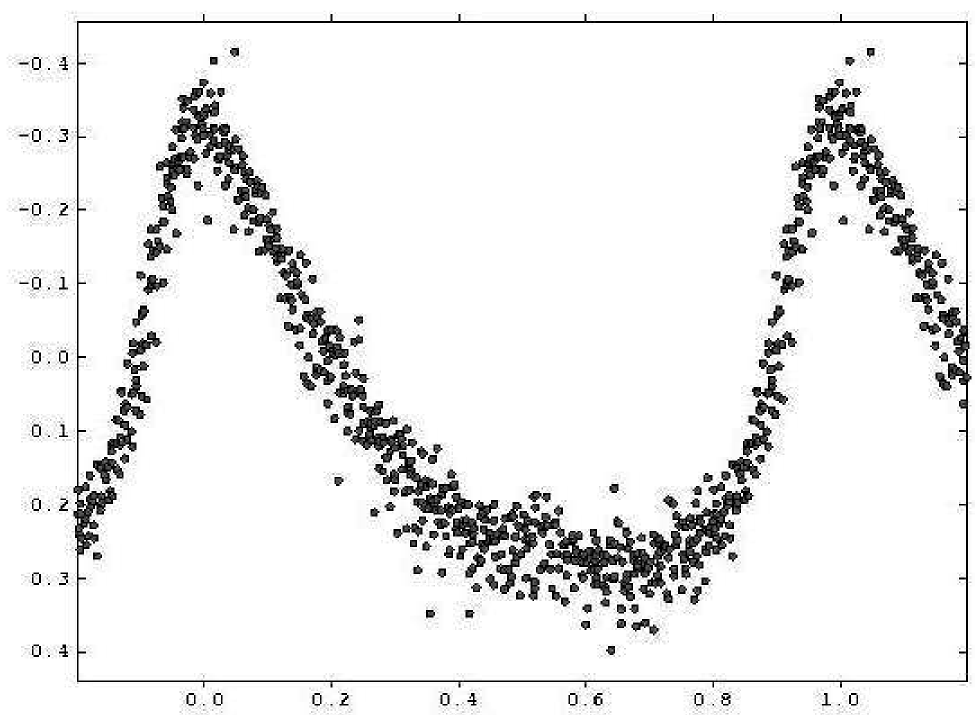

Figure 1. Phased light curve for DW Psc (BHO, unfiltered magnitudes with respect to GSC 614-00524).

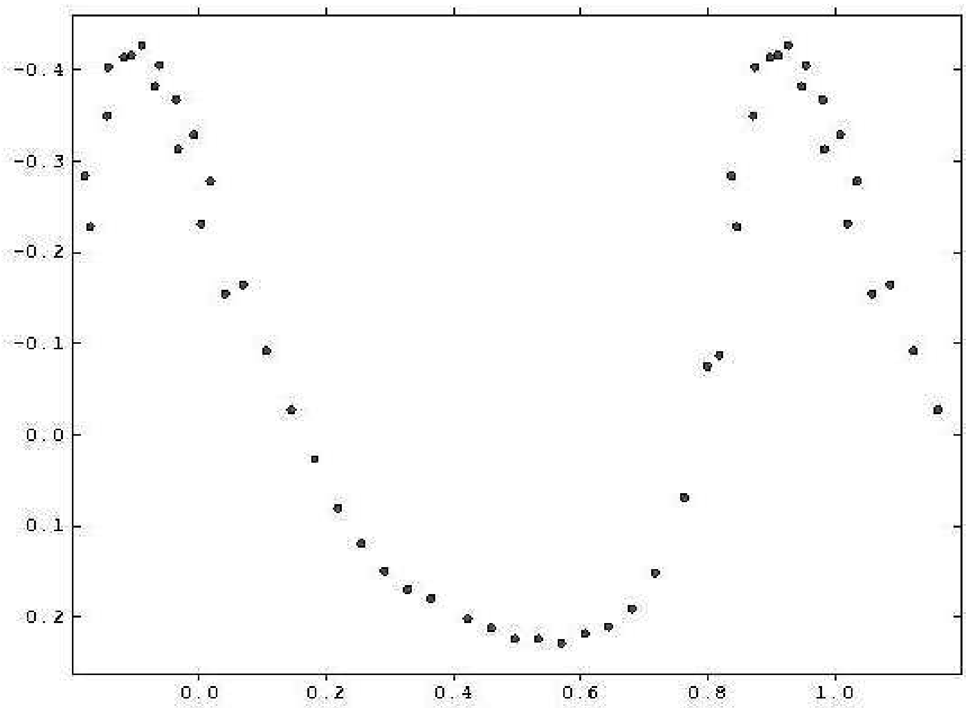

Figure 2. Phased light curve for DW Psc (NAO, V magnitudes with respect to GSC 614-00524).

Fig. 1 shows the phased light curve from the unfiltered BHO data (2001-2002) and Fig. 2 the phased light curve from the V data taken at NAO.

With the same method as above, a maximum was calculated from the data of Krugly (1999), giving HJD = 2450698.5135 and a large $O-C = 0^{\rm d}_{\cdot}0163$ (E = −25497). Adding one hour to this time of maximum would bring the $O-C$ back to $-0^{\rm d}_{\cdot}0017$ (E = −25496), which lies within the errors of the formula. However Krugly (2002, private communication) asserts that his observation times are correct (by comparing them with the positions of the asteroid 2100 Ra-Shalom which is on the images). If this is the case, the period of DW Psc has undergone a sudden change $\Delta P/P$ of at least -2×10^{-5} somewhere before the first observations at BHO in 1999. Thereafter the period seems to be constant. Although uncertain in this case, this sudden change is some 10 times larger than what is observed in Pop. II δ Scuti (SX Phe) stars (Breger and Pamyatnykh, 1998). However, we recall that an abrupt period break was detected in the case of V1162 Orionis (Hintz et.al., 1998). Intensive monitoring of this star later on showed that period changes of magnitude -1.6×10^{-5} are occurring (Arentoft et. al., 2001). Further observations of DW Psc would be needed to verify the constancy of the period or to disclaim it.

In the light curve of DW Psc at least four harmonics of the fundamental period can be detected. After prewhitening there is some evidence for further frequencies in the range 20−30 c/d, with an amplitude comparable to the observational error and a signal-to-noise ratio around 4. However, strong aliasing is involved. The timespan of the observations is too short to be conclusive about these frequencies. This is another reason to monitor the star in the future.

Acknowledgements: Dr. Y.N. Krugly is acknowledged for checking his observation times. P. Van Cauteren is grateful to the Royal Observatory of Belgium for putting at his disposal material acquired by project G.0265.97 of the Fund for Scientific Research (FWO) - Flanders (Belgium). P. Lampens and A. Strigachev acknowledge support received from the Belgian Federal Office for Scientific, Federal and Cultural Affairs (OSTC) and from the Bulgarian Academy of Sciences (BAS) in the framework of the project B9 "Astrometric, photometric and spectroscopic follow-up of binaries".

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NSV 786 IS NOT A CATACLYSMIC VARIABLE

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Along with the well known cataclysmic variables (CVs), the catalog of Downes et al. (1997) provides a large sample of stars suspected to be CVs. Among them there are still several relatively bright stars without published spectra. One of them is Cep2 (NSV 786). The TYCHO catalogue provides $V_T = 10^{\rm m}.09$ and $B_T - V_T = 0^{\rm m}.53$ thus the star is probably not a CV. However, this has to be spectroscopically confirmed. On 22 January 2002 single spectra of NSV 786 and star #1 in Fig. 1 (which also has no spectral classification) around Hα were obtained with the Coudé spectrograph of the 2-m telescope at Rozhen Observatory. The spectra showed neither Hα emission nor broad absorption (the later is observed in some UX UMa novalikes). Therefore neither star is a CV. A comparison with the spectral atlas of Montes et al. (1999) shows that the spectrum of star #1 closely matches that of a K5 giant, while NSV 786 itself is a late F star, most probably F8. This spectral classification of NSV 786 is fairly well consistent with the $B_T - V_T$ color index provided by TYCHO.

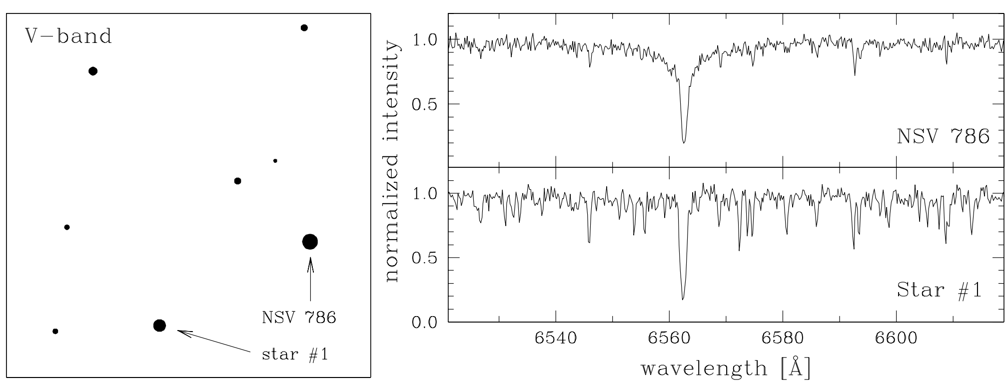

Figure 1. Finding chart and the spectra of NSV 786 and star #1 around Hα.

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Montes, D., Ramsey, L.W., Welty, A.D., 1999, *ApJS*, 123, 283

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THE FLARE ACTIVITY OF UV CETI 1982–1984

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Photoelectric monitoring observations of the flare star UV Cet have been carried out in 1982−1984, using the 60−cm telescope of the Rozhen National Astronomical Observatory and the UBV photon−counting, one channel, computer controlled photometer. The 1982 observations have been published in Panov et al. (1983) and Panov (1984). Here we list the flares observed in 1983−84 (Table 1). All observing runs were obtained with 1^{s} integration in the U band, because of superior flare detection. During the total of $10^{h}45^{m}35^{s}$ monitoring, 20 flares were observed. The flare characteristics in Table 1 have been described elsewhere (cf. Panov et al., 2000). The flare energy E_f is obtained as:

$$\log E_f = \log ED + \log E_q \qquad (1)$$

where:

$$E_q(U) = 2.77 \times 10^{27} \mathrm{ergs.s}^{-1} \qquad (2)$$

and

$$E_q(B) = 1.73 \times 10^{28} \mathrm{ergs.s}^{-1} \qquad (3)$$

are the quiescent stellar luminosities in the U and B band, respectively. These values are obtained with the respective stellar magnitudes and distance, taken from Gershberg et al. (1999).

We used the flares from Table 1 to study the flare activity of UV Cet and added also flares from other studies in 1982−1984, as follows:

4 U−band flares from Panov (1984), 8 U−flares from Panov et al. (1983), 2 B−band flares from Panov et al. (1983), 3 B−flares from Tsvetkov et al. (1983), 5 B−flares from Ilyin (1984), 1 B−flare from Orchiston et al. (1985), and 1 B−flare from Mavridis et al. (1990). Unfortunately, not all of the flares published are useful for our study, because of insufficient data.

Altogether, 30 U−band flares and 12 B−band flares were used. The B−band flare energies were converted to U−band energies, using (Lacy et al., 1976):

$$E_U = 1.20 \times E_B \qquad (4)$$

For the total sample of 42 flares (total duration=$45^h12^m27^s$) we calculated the cumulative flare energy distribution:

$$\log \nu = (14.3 \pm 2.5) - (0.49 \pm 0.09) \log E_f(U) \qquad (5)$$

where $\nu = \frac{N}{T}$ is the cumulative flare frequency and a and b are constants (cf. Gershberg and Shakhovskaya, 1983). Note that flares No. 9 and No. 12 are not included in the sample, as we registered only a part of the descending light curve. Moreover, in the fit (5) we consider only the linear part of the cumulative distribution, corresponding to energies greater than $\log E_f(U) = 29.4$. In our case, this is the threshold of full flare detection. In Fig 1, we plotted the total flare sample, together with the linear fit from (5). Also shown are the solutions from Gershberg and Shakhovskaya (1983) and Lacy et al. (1976). Our solution for the parameters a and b shows significant difference from the two previous solutions in the sense that during 1982–1984 UV Cet possibly was in a state of increased flare activity.

We would like to thank Dr. K. Olah for her valuable suggestions.

Table 1. Characteristics of the U–band flares for UV Cet.

No.	Date [UT]	Flare max [UT]	t_{rise} [sec]	Duration [m:s]	Noise $\frac{\sigma}{I_0}$	Amplitude $\frac{I_{0+f}-I_0}{I_0}$	Δm [mag]	$\log E_f$ [ergs]
1.	02.10.1983	23:44:12	11	6^m07^s	0.41	7.83	2.36	29.69
2.	02.10.1983	23:55:53	88	8^m52^s	0.23	3.93	1.73	30.23
3.	03.10.1983	00:05:21	62	2^m28^s	0.58	4.35	1.82	29.67
4.	05.10.1983	22:58:45	5	2^m02^s	0.73	5.86	2.09	29.52
5.	05.10.1983	–	–	2^m42^s	0.49	> 1.45	> 1.00	–
6.	06.10.1983	00:15:10	38	2^m56^s	0.52	3.78	1.70	29.49
7.	06.10.1983	23:31:48	32	2^m22^s	0.43	2.63	1.40	29.01
8.	09.11.1983	–	–	$> 15^m34^s$	0.15	> 3.7	> 1.7	–
9.	10.11.1983	21:50:59	30	7^m16^s	0.38	4.84	1.90	29.54
10.	10.11.1983	22:02:24	61	2^m23^s	0.38	1.89	1.14	29.03
11.	04.01.1984	17:21:25	16	1^m40^s	0.45	4.00	1.75	29.32
12.	04.01.1984	17:53:42	23	1^m59^s	0.46	3.52	1.62	29.52
13.	04.01.1984	18:08:35	5	24^s	0.24	2.38	1.35	28.34
14.	04.01.1984	18:16:02	35	3^m07^s	0.34	2.63	1.40	29.19
15.	04.01.1984	18:43:41	29	2^m06^s	0.55	5.73	2.07	29.64
16.	23.11.1984	21:04:55	39	9^m04^s	0.39	2.29	1.28	29.65
17.	23.11.1984	20:20:56	31	6^m49^s	0.45	15.84	3.07	30.14
18.	23.11.1984	20:47:36	40	1^m01^s	0.37	3.03	1.51	29.10
19.	24.11.1984	20:43:27	7	3^m36^s	0.63	7.67	2.34	29.67
20.	25.11.1984	20:49:56	44	4^m14^s	0.65	3.98	1.74	29.58

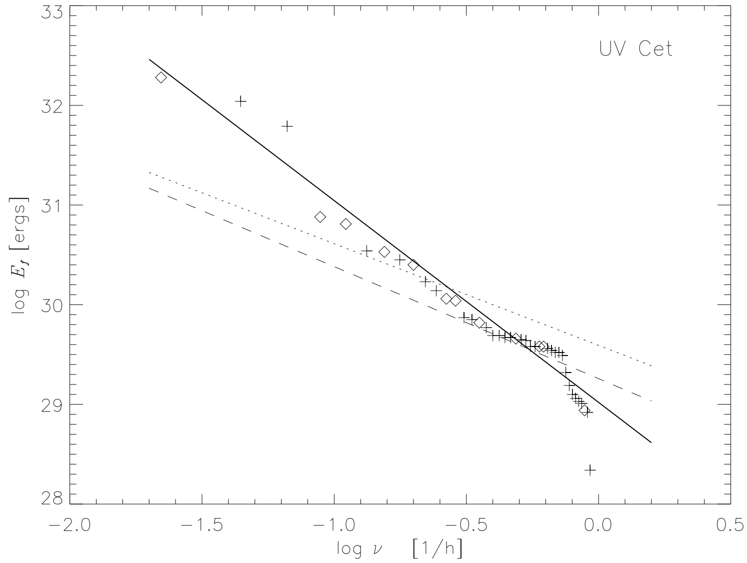

Figure 1. Cumulative flare energy distribution of our sample (full line), Gershberg and Shakhovskaya (1983) (dashed line), and Lacy et al. (1976) (dotted line). Crosses are U band flares and diamonds are B band flares.

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TIMES OF MINIMA OF ECLIPSING BINARIES

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Observatory and telescope:
URSA Observatory at the University of Arkansas (ursa.uark.edu); 10-inch Schmidt-Cassegrain reflector.

Detector:	1020×1530 pixels SBIG ST8EN CCD cooled to (typ.) -15 °C; $1\farcs15$ square pixels; $20'(N-S) \times 30'(E-W)$ field of view.

Method of data reduction:
Virtual measuring engine (Measure 1.8) written by C.H.S. Lacy (2002)

Method of minimum determination:
Kwee & van Woerden (1956)

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
KP Aql	EA/DM	19 02 30	+15 48 01	00693 01585[1]	40396.4912	3.36747959	1
MU Cas	EA/DM	00 15 52	+60 25 54	01331 04014	51876.5835	9.652926	2
V396 Cas	EA/DM	23 13 36	+56 44.1	01337 04006	52180.7074	5.50545	2
V459 Cas	EA/DM	01 11 30	+61 08 48	00792 04030	51144.6845	8.458294	2
VZ Cep	EA/DM	21 50 11	+71 26 38	01497 04470	52054.8522	1.1833648	2
WW Cep	EA/DM	22 18 28	+69 51 40	00262 04467	51139.3157	4.60084540	2
RT CrB	EA/RS	15 38 03	+29 29 14	00004 02039	28273.243	5.1171590	3
RW CrB	EA/DM	15 39 15	+29 37 20	00004 02039	51931.9083	0.7264114	2
V885 Cyg	EA/DM	19 32 50	+30 01 17	01184 02655	52024.9940	1.6947950	2
V1061 Cyg	EA/D	21 07 21	+52 02 58	00278 03600	51159.3789	2.346656	2
LV Her	EA/DM	17 35 32	+23 10 31	00580 02076	52066.6996	18.4359348	4
FL Lyr	EA/DM	19 12 05	+46 19 27	00050 03542	45143.7256	2.1781542	5
CF Tau	EA/D	04 05 10	+22 29 48	00008 01814	51918.3467	2.75589	2
BP Vul	EA/DM	20 25 33	+21 02 18	01837 01644	51063.6717	1.9403491	2

Source(s) of the ephemeris:
1: Lacy (1987), 2: This paper, 3: General Catalogue of Variable Stars, Kholopov (1985), 4: Torres et al. (2001), 5: Popper et al. (1986)

[1]The names of the comparison stars are from the GSC

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
KP Aql	52037.85597	0.00019	1	V	−0.01217	
MU Cas	52181.8024	0.0004	2	V	.00000	Sec. E=52181.8024
	52233.7417	0.0006	1	V	−0.0001	
V396 Cas	52078.8564	0.0004	2	V	−0.0002	Sec. phase=0.5
	52100.8763	0.0007	2	V	−0.0021	
	52111.8886	0.0005	2	V	−0.0007	
	52180.7074	0.0003	1	V	0.0000	
V459 Cas	52159.67448	0.00022	1	V	−0.0053	
	52176.5911	0.0006	1	V	−0.0053	
VZ Cep	52038.8768	0.0005	2	V	0.0000	Sec. phase=0.5
	52044.7941	0.0005	2	V	+0.0005	
	52051.8941	0.0005	2	V	+0.0003	
	52054.85215	0.00011	1	V	−0.00005	
	52073.7857	0.0002	1	V	−0.0003	
	52076.7444	0.0003	2	V	0.0000	
	52079.7030	0.0003	1	V	+0.0001	
	52080.88604	0.00019	1	V	−0.00019	
	52093.9027	0.0005	1	V	−0.0005	
	52108.6963	0.0003	2	V	+0.0010	
	52111.6527	0.0006	1	V	−0.0010	
	52112.83709	0.00014	1	V	+0.00001	
	52114.6150	0.0006	2	V	+0.0029	
	52154.8447	0.0004	2	V	−0.0018	
	52159.5800	0.0010	2	V	0.0000	
	52166.6797	0.0003	2	V	−0.0005	
	52179.6971	0.0003	2	V	0.0000	
	52233.5407	0.0004	1	V	+0.0004	
WW Cep	52084.7911	0.0004	2	V	+0.0017	Sec. phase=0.5
	52091.6908	0.0003	1	V	+0.0001	
RT CrB	52011.7312	0.0009	1	V	−0.0124	
RW CrB	51960.9651	0.0003	1	V	+0.0003	
	52038.6919	0.0003	1	V	+0.0011	
	52046.6823	0.0003	1	V	+0.0010	
	52055.7604	0.0010	2	V	−0.0010	Sec. phase=0.5
	52078.6449	0.0003	1	V	+0.0015	
	52080.8243	0.0004	1	V	+0.0015	
V885 Cyg	52058.894	0.003	1	V	+0.0041	
	52154.6433	0.0004	2	V	−0.0025	Sec. phase=0.5
V1061 Cyg	52095.6909	0.0002	1	V	−0.0037	
	52102.73118	0.00015	1	V	−0.0034	
	52109.77080	0.00014	1	V	−0.0038	
	52149.6636	0.0004	1	V	−0.0041	
LV Her	52066.6993	0.0008	1	V	−0.0003	
FL Lyr	52051.74277	0.00017	2	V	+0.00112	Sec. phase=0.5
CF Tau	52178.7796	0.0005	2	V	+0.0013	Sec. phase=0.5
BP Vul	52031.90450	0.00015	1	V	−0.00140	
	52064.89086	0.00009	1	V	−0.00098	
	52096.86757	0.00015	2	V	−0.00042	Sec. E=52098.80834
	52098.80834	0.00016	2	V	0.00000	
	52099.8166	0.0002	1	V	−0.0015	
	52101.75702	0.00010	1	V	−0.00145	
	52164.7794	0.0003	2	V	−0.00099	
	52165.78900	0.00012	1	V	−0.0008	

Remarks:

A sample of the observations has been published by Lacy, Hood & Straughn (2001).

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OBSERVATIONS OF OUTSIDE-ECLIPSE BRIGHTNESS VARIATIONS OF CM Dra

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CM Dra is a spotted eclipsing binary star with a period of 1.27 days. Strassmeier et al. (1993) reckoned this star among the BY Dra type variables and included it in their catalogue of chromospherically active binary stars. The BY Dra stars and their cousins, the RS CVn stars, often show brightness variations caused by star spots. Such variations in CM Dra were observed by Lacy (1977). These variations proved to be sine wave with an amplitude of about 0.02 mag. Probably, because of their low amplitude these variations were not described in the literature after 1977. In the present paper we report results regarding the outside-eclipse brightness variations of CM Dra from our observations obtained at Kourovka observatory of the Ural State University during 1996–97.

Some particular characteristics of CM Dra, mainly small sizes of the components (their total surface area is about 12% of the solar value (see Lacy 1977, for all system elements)) make this star suitable in order to search for extrasolar planets by means of differential photometry. However, such a task needs a large amount of observations. To obtain sufficient observational coverage, the "TEP" (Transits of Extrasolar Planets) network was formed with the participation of several observatories (Deeg et al. 1998, Doyle et al. 2000). At Kourovka observatory we performed the CM Dra observations as a part of the TEP network observations. We used the 70 cm telescope and the two-star photometer (Kozhevnikov & Zakharova 2000). The observations were made through a standard R filter. The total duration of our observations obtained during 43 nights is 155 hours.

Besides the main goal of these observations, i.e. detecting of transits of planets orbiting in the plane of binary components, we decided to construct a composite lightcurve of CM Dra in order to derive some orbital elements of the system. It seemed to be not a very simple task because the differential lightcurves showed slow airmass-related changes from differential extinction due to the large colour difference between CM Dra and the comparison star. These slopes of the differential lightcurves in the TEP network observations were removed by subtraction of a polynomial fit to the off-eclipse lightcurves (Deeg et al. 1998). In order to construct the composite lightcurve, using the data obtained at Kourovka observatory, we decided not to remove the slopes of the individual lightcurves, hoping that they would be averaged owing to the large amount of the observations (155 hours). Besides the extinction, the slopes can contain brightness variations caused by star spots if they are present on the binary components. These brightness variations have to occur over approximately the same time-scale as the extinction since the period of CM Dra's components is very likely locked to the binary period of 1.27 days. CM Dra is a very old system (see, for example, Viti et al. 1997), and its components have to be completely in synchronous rotation. Thus, having not removed the slopes of the individual lightcurves, we could detect outside-eclipse brightness variations of CM Dra. Unfortunately, during almost two years of our observations the instrumental colour system underwent little changes that resulted in the average differential magnitudes somewhat different for different observing seasones. These average differential magnitudes were previously subtracted from the individual lightcurves belonging to the different observing seasons.

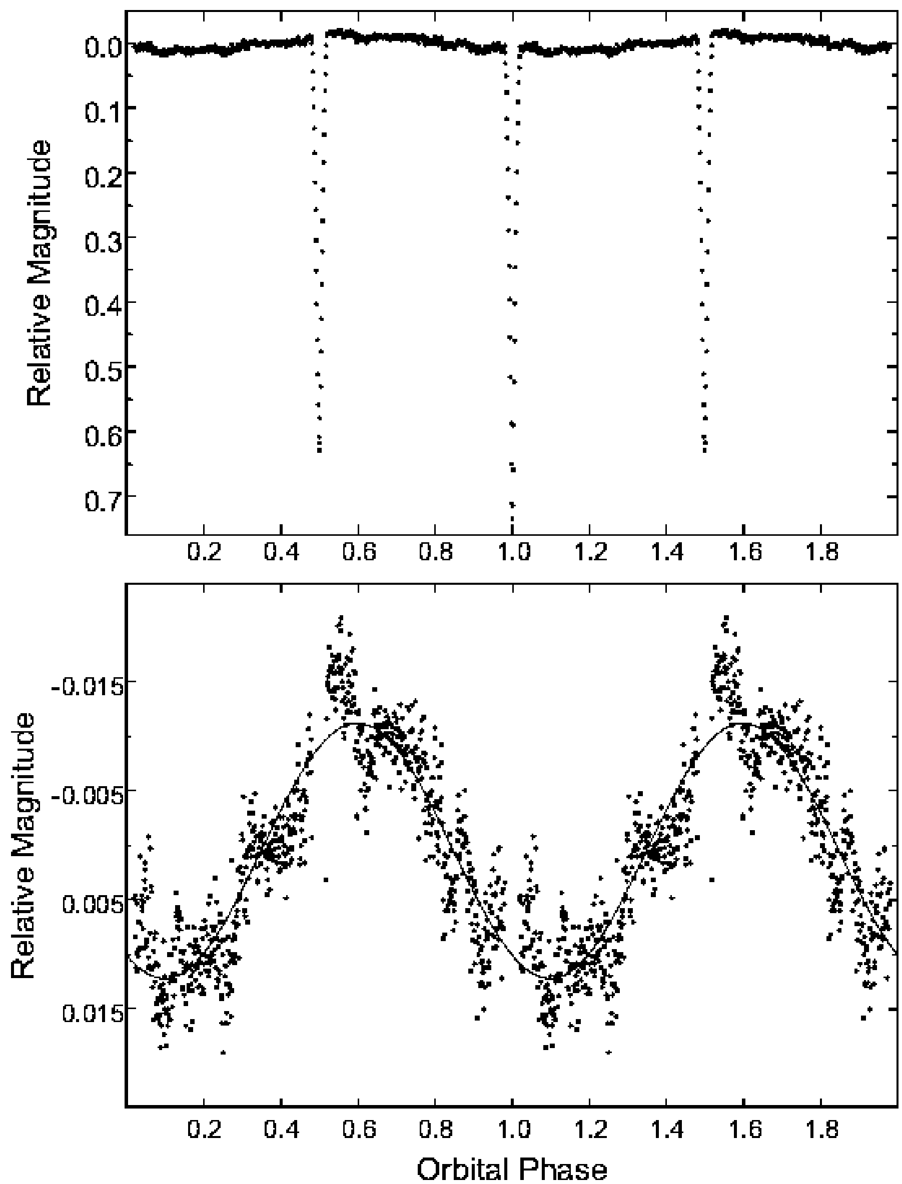

Figure 1. Composite lightcurve of CM Dra. The lower frame shows an expanded view of the outside-eclipse variations. The solid curve is the best-fitting sine wave. Two periods are shown for the sake of clarity

The composite lightcurve obtained by averaging all our observations of CM Dra is shown in Fig. 1. We used 856 bins per phase. The duration of the phase bins equals the exposure time (128 seconds). Each point is the average magnitude of 4–6 individual measurements obtained in different nights. The outside-eclipse brightness variations with an amplitude of about 0.02 mag are clearly visible in this lightcurve. As mentioned above, similar sinusoidal variations of the off-eclipse lightcurve of CM Dra with the same amplitude were found by Lacy (1977). However, there is a remarkable distinction between the results obtained by Lacy in 1976 and our results. The phase of maximum brightness that was obtained twenty years prior to our observations was 0.28, whereas the phase of maximum brightness in our observations is 0.60. The difference is approximately equal to one third of the orbital period.

Since our observations cover almost two years, we tried to find the difference of the phases of maximum brightness between 1996 and 1997. In order to make this, we constructed two composite lightcurves, using the data of 1996 and 1997 separately. Then we found the phases of maximum brightness, using sine wave fits to these lightcurves. Unfortunately, as seen in Fig. 1, the points around the sine wave are not distributed smoothly. In order to obtain more realistic values of formal errors from least squares technique, we averaged points of the lightcurves in 0.02 phase bins. Then sine waves were fitted to these lightcurves consisting of 50 points. The results with their rms errors are given in Table 1. As follows from Table 1, the difference of the phases of maximum brightness for the two years only slightly exceeds the triple interval of the rms errors, and we cannot draw a conclusion about the appreciable change of the phases of maximum brightness between 1996 and 1997. On the contrary, we can conclude that these phases can change significantly within one decade or more (as follows from the comparison of our observations and the observations made by Lacy (1977)).

Table 1. The information about the best-fitting sine waves

time interval	number of nights	duration (hours)	semiamplitude (magnitude)	phase of maximum
1996 April–October	22	68	0.010 ± 0.002	0.517 ± 0.023
1997 April–October	21	87	0.013 ± 0.001	0.635 ± 0.009
all the data	43	155	0.012 ± 0.001	0.597 ± 0.008

Brightness variations of the BY Dra and RS CVn stars are usually considered to be the effect of star spots that covered appreciable parts of the surfaces of one or both components of the system. The strong resemblance of the shapes and amplitudes of such variations in CM Dra that were observed in 1976 (see Fig. 5 of Lacy 1977) and in 1996–97 seems amazing and may mean that these brightness variations are caused by the same feature, namely, a spotted region on the star.

As seen in Fig. 1, the brightness variations in CM Dra have a smooth shape without a flat top or bottom. As noted by Lacy (1977), such a shape of brightness variations may mean that the spotted area is located very close to the rotational pole of one of the stars, since otherwise it would be out of view at some point in the orbit. Another hint that the spotted area in CM Dra is located close to the rotational pole may be the low amplitude of the brightness variations. As far as one can see in the data given by Strassmeier et al. (1993) in the catalogue of chromospherically active binary stars, brightness variations due to star spots in the BY Dra stars have usually greater amplitudes than in CM Dra and can reach several tenth of a magnitude. If the spotted area in CM Dra is similar to the spotted areas in most of the BY Dra stars, then by assuming the location of the star spot almost strictly on the rotational pole one can easily account for the small amplitude of the brightness variations due to a slightly nonsymmetric shape of the star spot. Also the change of the phases of maximum brightness between 1976 and 1996–97 can be explained, supposing a little change in shape or asymmetry of this large polar star spot after 1976.

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BV(RI)$_C$ OBSERVATIONS OF FY Vul

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FY Vul is a poorly known dwarf nova (DN) of the Z Cam subtype, characterized by a typical interval time between two subsequent outbursts of 30-50 days (Richter, 1961). The star varies between B=13$^{\rm m}_{.}$4 to B=15$^{\rm m}_{.}$3 (Downs and Shara, 1993). First photometric studies were made by Meinunger (1965), while Bruch (1984) reported the color index of the variable: $(U-B)$=$-$0$^{\rm m}_{.}$65 and $(B-V)$=0$^{\rm m}_{.}$53. Spectroscopic observations were taken by Downes et al. (1995): they revealed Hα in emission, while Hβ and Hγ are in absorption with an emission core. Although, the spectrum is typical of a dwarf nova near the end of an outburst and it confirms the DN classification for the object, the overall variability is less than 2 magnitudes.

In this paper we report photometric observations of FY Vul obtained at the Teramo Astronomical Observatory of Collurania in August-September 1998, and at the Perugia Astronomical Observatory in July-August 2001. The first series of observations were taken with the 0.72 m Ritchey-Chretien reflector of Collurania, equipped with a Tektronix 512 CCD camera and B, V (Johnson), R_C, I_C (Cousins) filters: the data are reported in Table 1. The photometric techniques used have already been described in two parallel papers about V503 Cyg (Spogli et al. 2000a) and V516 Cyg (Spogli et al. 2000b). The standard magnitudes of the comparison stars are reported by Misselt (1996), additionally, we calibrated the standard magnitudes of some of these stars with the I_C filter: I_C(2)=13$^{\rm m}_{.}$24$\pm$0$^{\rm m}_{.}$04, I_C(3)= 12$^{\rm m}_{.}$96$\pm$0$^{\rm m}_{.}$04, I_C(4)=13$^{\rm m}_{.}$82$\pm$0$^{\rm m}_{.}$04, I_C(5)= 13$^{\rm m}_{.}$99$\pm$0$^{\rm m}_{.}$04, and I_C(11)=13$^{\rm m}_{.}$13$\pm$0$^{\rm m}_{.}$04.

Table 1: $BV(RI)_C$ magnitudes of FY Vul in August-September 1998

Date	JD (2451000+)	B	V	R_C	I_C
30/08/1998	56.385	15.11±0.08	14.76±0.05	14.47±0.04	14.23±0.04
31/08/1998	57.368	14.98±0.05	14.66±0.04	14.31±0.04	14.10±0.04
01/09/1998	58.351	14.89±0.05	14.52±0.04	14.28±0.04	13.99±0.04
02/09/1998	59.355	14.83±0.06	14.50±0.04	14.21±0.04	13.97±0.04

We observed FY Vul in July-September 2001 with the 0.40 m Automatic Imaging Telescope at the Perugia University Observatory. The equipment used and the procedures of data analysis have already been described in Spogli et al. (1998). The $BV(RI)_C$ data collected are reported in Table 2.

Table 2: $BV(RI)_C$ magnitudes of FY Vul in July-September 2001

Date	JD (2451000+)	B	V	R_C	I_C
15/07/01	1106.589	14.65±0.08	14.19±0.02	14.01±0.03	13.59±0.04
17/07/01	1108.551	14.88±0.03	14.25±0.01	14.72±0.02	13.91±0.04
22/07/01	1113.517	14.79±0.13	14.61±0.05	14.29±0.06	13.74±0.04
23/07/01	1114.479	14.77±0.11	14.49±0.03	14.26±0.07	13.97±0.04
24/07/01	1115.469	14.85±0.08	14.59±0.07	14.26±0.03	13.97±0.04
27/07/01	1118.480	14.74±0.09	14.47±0.06	14.27±0.03	13.92±0.04
28/07/01	1119.541	14.71±0.09	14.34±0.06	14.14±0.04	13.57±0.04
04/08/01	1126.415	14.22±0.12	14.09±0.04	13.92±0.04	
05/08/01	1127.406	14.55±0.13	14.13±0.07	14.08±0.05	
06/08/01	1128.413	14.52±0.13	14.39±0.05	14.25±0.05	13.83±0.04
09/08/01	1131.408	14.81±0.08	14.62±0.04	14.39±0.03	14.06±0.04
11/08/01	1133.414	14.79±0.11	14.38±0.03	14.15±0.05	13.88±0.04
12/08/01	1134.413	14.58±0.04	14.39±0.03	14.09±0.07	13.93±0.04
13/08/01	1135.562	14.63±0.08	14.43±0.03	14.26±0.07	13.88±0.04
14/08/01	1136.395	14.65±0.07	14.37±0.05	14.11±0.05	13.88±0.04
18/08/01	1140.389	14.15±0.09	13.94±0.05	13.71±0.04	13.49±0.04
19/08/01	1141.419	14.28±0.07	13.97±0.05	13.85±0.04	
20/08/01	1142.366	14.32±0.07	14.05±0.05	13.85±0.04	13.64±0.04
21/08/01	1143.421	14.32±0.09	14.16±0.05	13.94±0.04	13.66±0.04
27/08/01	1149.443	14.87±0.06	14.45±0.06	14.23±0.04	13.92±0.04
28/08/01	1150.382	14.64±0.14	14.44±0.07	14.23±0.06	13.74±0.04
12/09/01	1165.328	14.83±0.13	14.55±0.09	14.32±0.07	14.09±0.05

The light curve (see Figure 1) seems to show quasi-periodic variation with a period of $\sim$ 15-20 days, and a full amplitude of $\sim$ 0.7 mag. Probably FY Vul was in a long phase of standstill, but it is not excluded in a previously unrecognized group of low-amplitude dwarf novae (see Kato et al. 1999). Table 3 resumes the main photometric characteristics of the variable during this phase.

Table 3: Photometric characteristics of FY Vul in July-September 2001

	B	V	R_C	I_C
Maximum	14.15	13.94	13.71	13.57
Minimum	14.88	14.62	14.49	14.09
Mean color index	$(B-V)$	$(V-R_C)$	(R_C-I_C)	$(V-I_C)$
	0.29	0.18	0.33	0.51

To study the behavior of the optical continuum of FY Vul, we computed the spectral index α using the same procedure used in Spogli et al. (1998), neglecting interstellar reddening. We find that in this phase the spectral distribution is probably dominated by the emission of the secondary star. However, more observations are needed to clarify the nature of this interesting object.

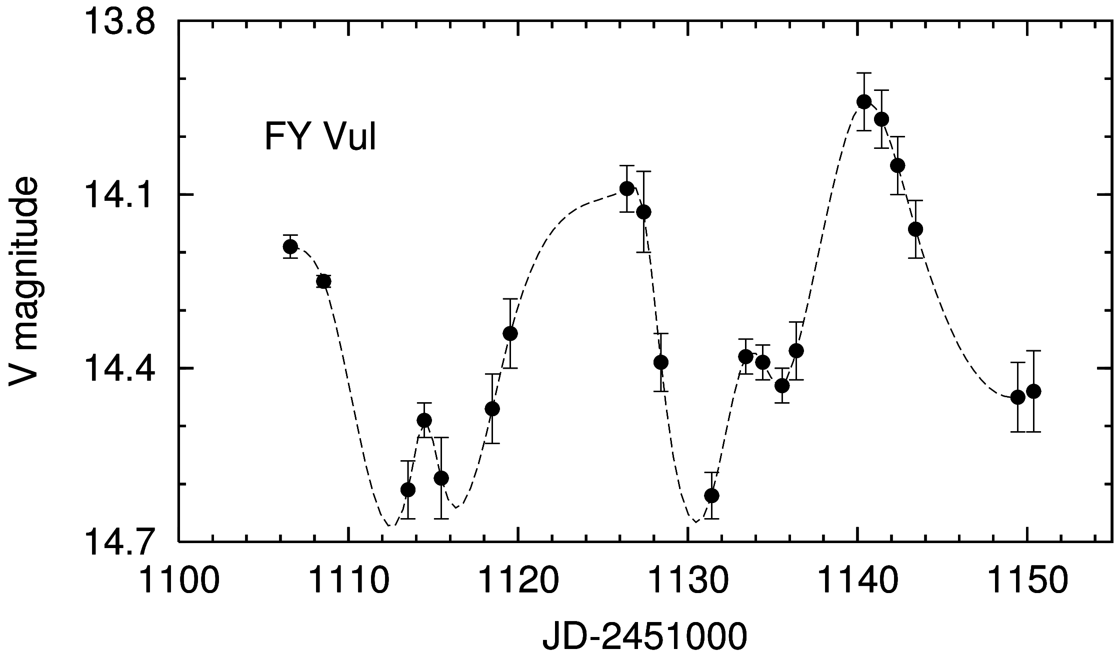

Figure 1. Light curve of FY Vul. Dashed line connects consecutive points by natural cubic spline after rendering the data monotonic

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VARIABLE STARS IN FIELD A OF NGC 6822

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In the context of our programme to study Cepheids in nearby galaxies (Antonello et al. 1999), we observed 5 fields in the irregular galaxy NGC 6822 (a Local Group member with $m - M = 24\overset{\mathrm{m}}{.}5$) during 3 runs from 1996 to 1998. The observations were performed with the direct CCD camera attached to the Dutch 0.9m telescope of the La Silla Observatory. Each field has a size of $3\overset{\prime}{.}8 \times 3\overset{\prime}{.}8$. Most of the observations were performed without filter (Wh band) in order to get the best photon statistics for detecting the variability of very faint objects (Antonello et al. 1999; Antonello et al. 2000; Riess et al. 1999). Two images in V and R filters were taken to get information about star colors.

A sufficient number of frames to allow a reliable study of time series have been obtained for Field A, for which we have 34 Wh images. This field is approximately at the centre of the galaxy (its coordinates are $\alpha_{2000} = 19^{\mathrm{h}}44^{\mathrm{m}}58^{\mathrm{s}}$, $\delta_{2000} = -14^\circ 48' 18''$). The data reduction and calibrations of these frames, the methods adopted to detect variable objects, together with the results concerning the Cepheid–like variables were presented and discussed by Antonello et al. (2002). An approximate transformation of our Wh magnitudes to V ones is given by $V = Wh - 0.04(V - R) + 0.38(V - R)^2$.

In this note we report the newly discovered variable stars belonging to other classes. In the field we got reliable measurements for 4552 stars and among them we detected 130 variable objects. From the scatter of the data of non-variable objects we estimate that the external standard deviation is about 0.1 mag at Wh=$21\overset{\mathrm{m}}{.}0$ and 0.2 mag at Wh=$22\overset{\mathrm{m}}{.}0$. The group of variable stars includes 21 Cepheids and 4 W Vir stars, discussed by Antonello et al. (2002), and another 13 periodic variables, none of which was previously known, listed with their main characteristics in Table 1.

The remaining 91 objects are long period or irregular variables; three of them were previously detected by Kayser (1967). They are listed in Table 2. Given the distribution of our observations, no reliable period or time−scale of variation can be determined. The observed amplitudes range from about 0.15 to 2.0 mag; in particular, for V1534, V1838, V2881, V3389 (Kayser variable V10) and V3587, variations larger than 1 mag were observed. For the other two Kayser variables (V19 and V23, corresponding to ours V0384 and V1023), variations of 0.24 and 0.43 mag were observed, respectively. Most of these stars are red. However there are also a few blue (e.g. V1795 and V3416), and intermediate colour objects.

Table 1. Periodic variables in Field A of NGC 6822

Name	$\alpha(2000)$ [^{h} ^{m} ^{s}]	$\delta(2000)$ [$^{\circ}$ $'$ $''$]	P [d]	Wh	$V-R$ [mag]	Ampl.
V0363	19 45 05.31	−14 49 25.2	22.88	21.74	2.10	0.3
V0646	19 44 54.24	−14 48 50.2	1.254	22.91	–	0.6
V1038	19 44 51.74	−14 48 03.2	0.9291	21.48	1.23	0.2
V1486	19 44 56.80	−14 47 14.6	57.46	20.73	2.06	0.3
V1550	19 44 51.49	−14 47 08.2	35.11	20.46	2.91	0.4
V1829	19 45 02.85	−14 46 30.7	2.11	21.44	1.50	0.3
V2302	19 44 53.71	−14 47 35.4	0.8430	21.25	1.80	0.2
V2508	19 44 51.33	−14 49 57.4	1.0338	21.20	1.19	0.2
V2694	19 44 51.11	−14 48 37.0	20.84	21.37	1.54	0.15
V2872	19 44 56.20	−14 47 30.8	1.550	22.41	1.14	0.8
V3034	19 44 58.00	−14 46 24.6	30.1	22.34	0.45	0.4
V3748	19 44 56.21	−14 46 53.9	33.53	20.54	2.04	0.2
V4443	19 44 54.74	−14 50 05.2	0.6479	23.16	–	1.2

The identification map for the variable stars is reported in the paper of Antonello et al. (2002).

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Table 2. Long period and irregular variables in Field A of NGC 6822

Name	$\alpha(2000)$ [h m s]	$\delta(2000)$ [° ″ ′]	Wh	$V-R$	Ampl [mag]	Kayser Ident.
V0002	19 44 51.90	−14 50 11.3	20.74	1.77	0.23	
V0005	19 44 57.15	−14 50 09.5	20.42	1.21	0.19	
V0008	19 44 54.06	−14 50 10.3	20.01	1.94	0.16	
V0081	19 44 51.72	−14 50 03.9	20.73	1.31	0.38	
V0100	19 45 03.27	−14 49 59.8	21.28	1.70	0.42	
V0103	19 44 58.87	−14 50 00.5	20.99	2.24	0.17	
V0126	19 45 05.36	−14 49 54.6	21.34	1.63	0.39	
V0130	19 44 58.73	−14 49 55.7	20.86	1.73	0.26	
V0131	19 44 58.75	−14 49 54.4	21.26	2.01	0.91	
V0160	19 45 03.63	−14 49 50.4	20.92	1.50	0.30	
V0161	19 45 03.48	−14 49 49.4	20.70	1.62	0.18	
V0181	19 44 56.74	−14 49 49.2	20.03	0.68	0.37	
V0212	19 44 51.42	−14 49 47.0	21.08	3.24	0.29	
V0218	19 45 00.38	−14 49 43.9	19.97	0.81	0.15	
V0226	19 44 57.45	−14 49 43.7	21.00	2.58	0.57	
V0321	19 45 01.26	−14 49 31.8	20.16	1.87	0.19	
V0331	19 45 03.80	−14 49 27.0	21.24	2.29	0.55	
V0384	19 44 57.32	−14 49 20.0	16.80	1.56	0.24	V19
V0395	19 44 56.94	−14 49 22.0	20.82	1.74	0.55	
V0407	19 44 58.93	−14 49 20.0	21.71	1.99	0.67	
V0606	19 44 54.90	−14 48 55.5	21.78	–	0.79	
V0662	19 44 58.58	−14 48 46.8	21.64	–	0.49	
V0694	19 45 04.71	−14 48 42.3	21.14	2.31	0.42	
V0777	19 44 54.56	−14 48 28.6	21.10	1.45	0.29	
V0837	19 45 02.53	−14 48 23.9	20.95	2.02	0.31	
V0931	19 45 05.81	−14 48 15.0	21.25	3.04	0.58	
V1023	19 44 54.47	−14 48 06.4	17.67	1.53	0.43	V23
V1041	19 44 50.99	−14 48 05.1	22.87	1.35	0.76	
V1051	19 45 02.82	−14 48 01.2	21.93	–	0.65	
V1052	19 45 05.78	−14 48 00.2	20.96	1.37	0.15	
V1099	19 45 04.13	−14 47 54.3	20.76	1.74	0.19	
V1118	19 44 53.80	−14 47 52.2	19.92	1.81	0.20	
V1160	19 44 55.28	−14 47 44.1	20.77	1.15	0.25	
V1175	19 44 53.55	−14 47 47.2	21.78	1.29	0.80	
V1201	19 44 51.83	−14 47 46.1	21.06	2.87	0.31	
V1429	19 45 01.99	−14 47 17.8	21.37	–	0.67	
V1430	19 45 01.93	−14 47 15.7	21.51	3.13	0.40	
V1438	19 44 50.86	−14 47 07.0	22.04	1.71	0.49	
V1470	19 45 03.92	−14 47 10.8	21.51	1.55	0.90	
V1514	19 45 06.33	−14 47 05.7	21.10	1.60	0.43	
V1521	19 45 02.96	−14 47 09.4	21.28	1.38	0.40	
V1534	19 45 00.52	−14 47 05.0	21.25	3.00	1.17	
V1562	19 44 54.29	−14 47 01.7	20.62	2.24	0.29	
V1578	19 44 53.79	−14 47 00.4	21.02	1.48	0.41	
V1598	19 44 57.48	−14 47 00.2	21.58	2.07	0.18	

Table 2. (continued)

Name	$\alpha(2000)$ [h m s]	$\delta(2000)$ [° ′ ″]	Wh	$V-R$	Ampl. [mag]	Kayser Ident.
V1648	19 44 53.38	−14 46 56.5	21.00	2.18	0.22	
V1692	19 44 58.04	−14 46 47.2	21.20	0.90	0.55	
V1719	19 44 51.97	−14 46 47.0	20.90	2.17	0.27	
V1726	19 44 51.63	−14 46 48.1	20.43	1.52	0.28	
V1795	19 44 53.78	−14 46 35.2	20.54	−0.45	0.23	
V1819	19 44 54.24	−14 46 35.1	20.86	1.38	0.38	
V1838	19 44 53.65	−14 46 29.0	20.28	1.81	1.15	
V1878	19 45 05.70	−14 46 25.8	21.48	–	0.92	
V1898	19 45 03.42	−14 46 18.3	21.17	1.98	0.51	
V2003	19 44 56.39	−14 50 11.4	20.85	1.42	0.44	
V2005	19 45 01.97	−14 50 06.5	20.67	2.18	0.22	
V2007	19 44 51.62	−14 50 07.2	21.56	1.37	0.34	
V2009	19 44 57.42	−14 50 02.3	20.66	2.15	0.32	
V2021	19 45 01.20	−14 49 52.4	21.01	0.74	0.79	
V2099	19 44 57.63	−14 49 06.1	20.92	1.69	0.21	
V2107	19 45 02.47	−14 49 04.3	20.14	2.09	0.27	
V2132	19 44 51.64	−14 48 57.9	18.84	1.44	0.11	
V2144	19 44 58.32	−14 48 52.3	19.78	1.77	0.28	
V2167	19 44 51.95	−14 48 36.6	19.96	1.46	0.18	
V2194	19 45 04.94	−14 48 20.8	20.90	2.03	0.39	
V2197	19 44 56.12	−14 48 22.6	20.86	1.66	0.50	
V2198	19 44 53.53	−14 48 20.7	21.64	1.71	0.33	
V2214	19 44 51.66	−14 48 15.5	21.91	1.98	0.33	
V2229	19 44 58.55	−14 48 02.5	21.47	–	0.45	
V2248	19 44 52.39	−14 48 03.7	19.67	2.07	0.48	
V2351	19 44 56.40	−14 47 04.6	20.71	0.44	0.56	
V2379	19 44 55.86	−14 46 57.3	20.31	0.48	0.48	
V2540	19 44 55.76	−14 49 43.1	19.93	2.12	0.15	
V2639	19 45 01.03	−14 49 02.7	21.53	2.11	0.34	
V2677	19 44 51.77	−14 48 49.0	21.31	1.50	0.39	
V2718	19 44 57.60	−14 48 28.0	17.96	1.66	0.16	
V2881	19 44 58.84	−14 47 26.6	21.41	1.72	1.60	
V2883	19 45 05.07	−14 47 25.0	20.44	1.70	0.52	
V3198	19 45 03.79	−14 47 31.6	21.08	2.45	0.32	
V3389	19 44 54.20	−14 48 45.1	21.08	1.67	2.05	V10
V3391	19 44 54.97	−14 48 44.4	21.78	–	0.23	
V3416	19 44 57.87	−14 48 30.7	21.94	0.01	0.83	
V3440	19 44 54.93	−14 48 15.4	20.58	2.23	0.33	
V3491	19 44 53.81	−14 47 43.0	21.25	1.54	0.39	
V3587	19 44 59.43	−14 46 30.8	22.23	0.65	1.01	
V3610	19 44 56.75	−14 46 25.1	21.29	–	0.62	
V3642	19 44 55.50	−14 49 22.8	19.99	0.74	0.12	
V3699	19 45 01.11	−14 48 18.3	21.16	1.02	0.53	
V3775	19 44 54.50	−14 49 35.2	21.54	1.08	0.52	
V3808	19 44 59.17	−14 47 15.4	21.43	–	0.52	
V4175	19 44 57.70	−14 47 44.2	22.23	–	0.60	

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NEW V(RI)$_C$ PHOTOMETRY OF SW LACERTAE AND AB ANDROMEDAE

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In this note we present new CCD observations of two frequently observed close eclipsing binaries. The target stars, SW Lacertae (HD 216598, sp. type K0V, $V_{\rm max}$ ≈8.6 mag, P≈0.3207 d) and AB Andromedae (SAO 73069, sp. type G5V, $V_{\rm max}$ ≈9.6 mag, P≈0.3319 d), are known to exhibit strongly changing periods (SW Lac: Pribulla et al. 1999; AB And: Kalimeris et al. 1994). Furthermore, both stars show significant variations in the light curve shapes suggesting the presence of spots on the stellar surfaces (SW Lac: Pribulla et al. 1999; AB And: Djurašević et al. 2000). Therefore, continuous observations are needed to follow short- and long-term variations, either the period or the light curve shape is considered.

Our new data were acquired on seven nights in October, 2001, using the 0.4m Cassegrain-type telescope of Szeged Observatory. The detector was an SBIG ST–9 CCD (512×512 pixels) equipped with standard $V(RI)_{\rm C}$ filters. SW Lac was observed on four nights (Oct. 7, 12, 13 and 14), while AB And on three nights (Oct. 22, 23 and 27). As a result, full phase coverage was reached for both stars. The exposure time varied between 10 and 30 seconds, depending on the actual target brightness and weather conditions.

The data were reduced with standard tasks in IRAF[1]. We made aperture photometry with IRAF/DAOPHOT. The comparison and check stars were as follows: SW Lac – comp=GSC 3215-1586, check=GSC 3215-0906; AB And – comp=GSC 2763-0683, check=2763-0878. While the magnitude differences of the comparisons for AB And were constant within ±0.02 mag in all three bands, we found slightly changing data for the comparisons of SW Lac. Sample differential light curves obtained on Oct. 7, 2001 are shown in Fig. 1. The amplitude decrease with the increasing wavelength is characteristic for a pulsating variable. In order to determine which comparison is the variable one, we performed follow-up observations in V-band on December 8, 2001. The longer exposure times (50 to 90 seconds) allowed the use of many fainter field stars as additional comparisons. The measurements covering almost 6 hours revealed that the check star (GSC 3215-0906) changed its brightness on that night by about 0.05 mag. Thus, we conclude that it is a variable star and its use as comparison (or check star, as used by Borkovits & Bíró 1998 and Nelson 2000) for SW Lac should be avoided. Further observations are needed to clarify its real nature.

[1]IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

Table 1: New times of minimum for SW Lac and AB And

MJD_{min}	min	Filt.	MJD_{min}	min	Filt.
SW Lac			2452196.4256	I	V
2452190.3326	I	V	2452196.4266	I	R
2452190.3331	I	R	2452196.4255	I	I
2452190.3329	I	I	2452197.2274	II	V
2452190.4936	II	V	2452197.2279	II	R
2452190.4937	II	R	2452197.2280	II	I
2452190.4932	II	I	2452197.3869	I	V
2452195.3037	II	V	2452197.3880	I	R
2452195.3040	II	R	2452197.3885	I	I
2452195.3043	II	I	AB And		
2452195.4637	I	V	2452205.3345	I	V, R, I
2452195.4651	I	R	2452205.5026	II	V, R, I
2452195.4636	I	I	2452206.3326	I	V, R, I
2452196.2660	II	V	2452206.4982	II	V, R, I
2452196.2662	II	R	2452210.3151	I	V, R, I
2452196.2653	II	I	2452210.4806	II	V, R, I

The pure instrumental data were standardized in the usual way (e.g. Henden & Kaitchuk 1982) and the resulting differential photometry is available at the IBVS website (1498 and 692 individual points for SW Lac and AB And, respectively). The $(V - R_C)$ and $(V - I_C)$ colour indices were calculated for the epochs of V points by linear interpolation of the neighbouring R_C and I_C data. We show the obtained standardized light and colour curves in Fig. 2, where the data were phased using the updated periods taken from Pribulla et al. (2001).

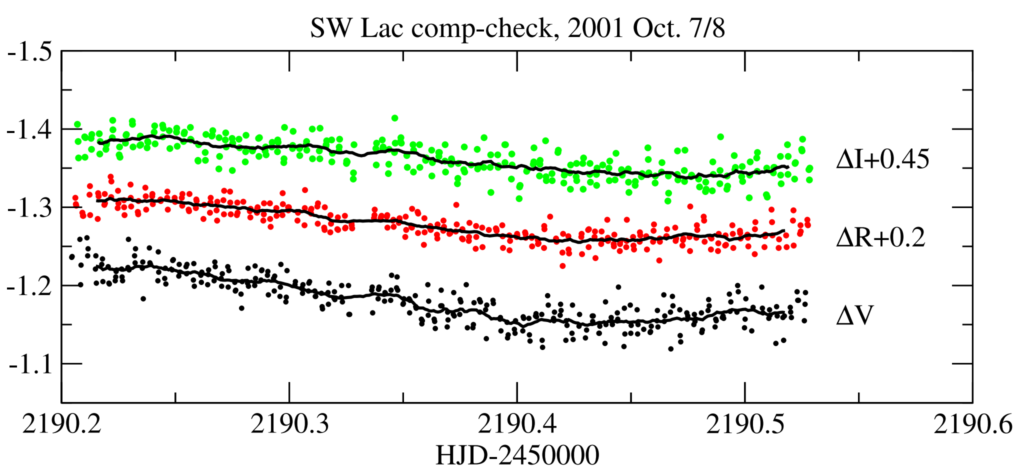

Figure 1. Differential light curves of the comparison stars of SW Lac. The solid lines denote running averages (binning length: 20 points).

In order to check the present status of the period change for SW Lac and AB And, we have updated their $O - C$ diagrams. For this purpose, 42 new times of minimum were determined from the original instrumental differential $V(RI)_C$ data by fitting low-order (4–5) polynomials to the lowest parts of the light curves. In order to check the

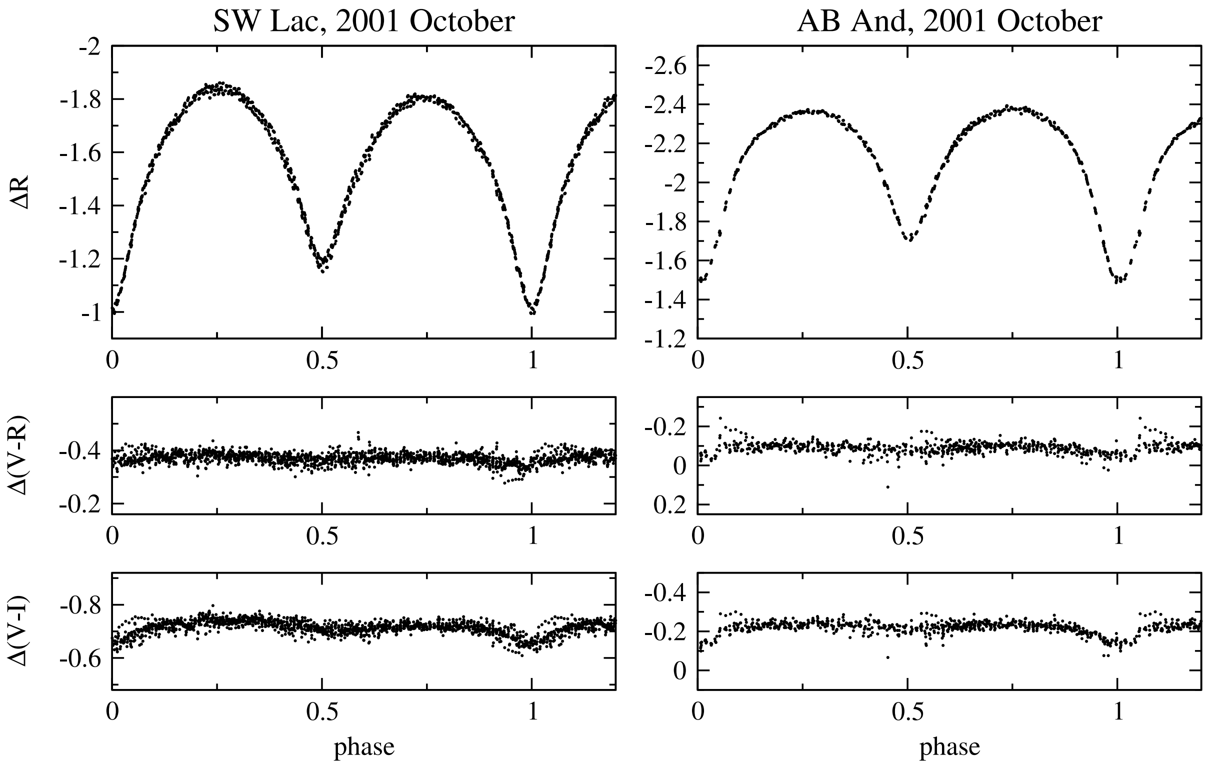

Figure 2. Standardized light and colour curves of SW Lac (HJD_0=2452190.3326) and AB And (HJD_0=2452205.3350).

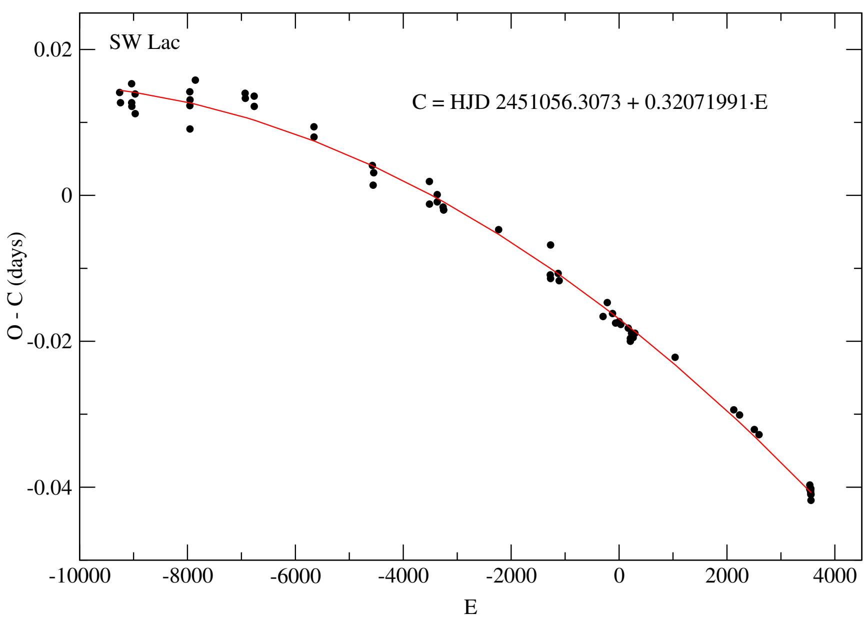

Figure 3. The $O - C$ diagram of SW Lac between 1990 and 2001. The ephemeris was taken from Pribulla et al. (1999), while the individual epochs of this diagram are available electronically at the IBVS website.

presence of some systematic differences between the epochs in different photometric bands, we have calculated the mean differences for both stars. The results for SW Lac are $\langle \mathrm{min_V} - \mathrm{min_R} \rangle = -55 \pm 38$ s and $\langle \mathrm{min_R} - \mathrm{min_I} \rangle = +35 \pm 57$ s, indicating that there is a tendency for earlier minima in V than in R, and I minima are simultaneous with R within the uncertainty limit. No significant differences which exceed the observational errors was found in the case of AB And. Table 1 lists the mean of the minima times of the $V(RI)_c$ observations for AB And, and the $V(RI)_c$ minima times separately for SW Lac.

Since the most recent period update was published by Pribulla et al. (2001), we compared our epochs to predictions based on their elements (numbers in parentheses). The mean $O-C$ values are the following: SW Lac (P=0.32071510 d, $\mathrm{MJD_0}$=51056.2896) $\langle O-C \rangle = -0.0062$ d (≈ -9 min); AB And (P=0.33189106, $\mathrm{MJD_0}$=51534.2504) $\langle O-C \rangle = +0.0020$ d ($\approx +3$ min). Longer $O-C$ diagrams covering the last 10 years revealed that the period of SW Lac has been continuously decreasing (well-defined downward parabola, as shown in Fig. 3). Contrary to SW Lac, AB And had constant period in the last decade (see Pribulla et al. 1999 and Borkovits & Hegedüs 1996 for discussions of the long-term behaviour). We conclude that the latest ephemeris given by Pribulla et al. (2001) for AB And is still applicable, while for SW Lac one should include the long-term behaviour of the period change into the predictions with the following quadratic elements:

$$HJD_{\min} = 2451056.2903 + 0.32071414(65) \cdot E - 2.57(30) \cdot 10^{-10} \cdot E^2$$

The light curve of SW Lac clearly shows the magnitude difference between the maxima (δV=0.05 mag, δR_C=0.04 mag, δI_C=0.03 mag), which is usually attributed to stellar spots on the components. A spot-fitting analysis is beyond the scope of the present paper, here we only note that BV photometry obtained in 1997 (Kiss et al. 1999) yielded such light curves, which showed larger asymmetries (δV=0.10 mag). For AB And, δV=0.02 mag, δR_C=0.02 mag, δI_C=0.01 mag and significant asymmetries of the minima were found, suggesting similar spot activity in 2001 as found by Djurašević et al. (2000) for 1990 (see their Fig. 1). A detailed analysis will address the long-term evolution of spot activity for both stars, for which follow-up observations are planned in the next few years.

This research was supported by the "Bolyai János" Research Scholarship of LLK from the Hungarian Academy of Sciences, FKFP Grant 0010/2001, Hungarian OTKA Grants #T032258 and #T034615 and Szeged Observatory Foundation. The observations were acquired during the course of Astronomical Seminars for students of astronomy at University of Szeged. The NASA ADS Abstract Service was used to access data and references. This research has made use of SIMBAD Database operated at CDS, Strasbourg, France.

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OBSERVATIONS OF THE FLARE STAR EV Lac IN 2000-2001

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In 2000-2001 we continued observations of the flare star EV Lac with the two-channel (U and B) fast photometer (Zalinian & Tovmassian 1989) installed at the 40 cm telescope of the Byurakan Astrophysical Observatory (BAO), Armenia. Observations with this photometer allowed us to study the light curve of a flare with high time resolution (0.5 s). In previous observations we have detected very short spiky flares of a duration less than a second with rising times of about 0.1 s (Zalinian & Tovmassian 1987, Tovmassian & Zalinian 1988, Zalinian & Tovmassian 1997, Tovmassian et al. 1997a). Fast flares of a duration of a few seconds have been registered also by Tsvetkov et al. (1986) and Shvartsman et al. (1988). Tovmassian et al. (1997b) showed that the spiky flares occur mostly after normal, longer lasting flares, and are systematically bluer than the preceding main flares (Tovmassian et al. 1997b).

The log of observations is presented in Table 1. The night sky background was measured several times during one observing run. Therefore, the total duration of observation of the star itself is less than the time between the start and the end of observations. Observations were made with integration time 0.5 s.

Table 1: The log of observations of EV Lac in 2000-2001.

Date	Start UT	End UT	Total duration h m
21 Aug 2000	20 00	20 56	0 45
23 Aug 2000	19 13	22 46	2 25
25 Aug 2000	18 45	22 53	2 35
26 Aug 2000	19 10	19 20	0 10
26 Aug 2000	19 30	22 29	2 30
27 Aug 2000	16 47	22 49	3 10
28 Aug 2000	18 55	00 32	4 15
04 Sep 2000	18 08	22 30	2 45
08 Oct 2001	17 20	18 52	1 10
24 Oct 2001	17 00	19 25	2 05

Since the aim of our observations was detection of fast flares, we measured the brightness of EV Lac in U and B in relation to its quiescent state. It is known that EV Lac is a variable star with an amplitude $\Delta V = 0^{m}.08$ (Pettersen, Kern & Evans 1983). In observations with the 40 cm telescope made with integration time 0.5 s such variations are certainly below the accuracy of our measurements. The comparison star C2 from Pettersen et al. (1983) was observed once in a night for controlling the registration system of the photometer.

During 22 hours of monitoring of EV Lac we detected three flares. Light curves of the detected flares, and also the variations of $(U-B)$ magnitudes of the star during flares, are presented in Figures 1-4. Each point on the $U-B$ graph is the average of 5 preceding and 5 subsequent measurements.

The flare on 23 August has relatively sharp rise and decline in the initial phase, followed by a slow decline (Figure 1). Unfortunately, the declining part of the flare is interrupted for the sky background measurement. However, the end of decline is seen on the record made after the sky background measurement. The total duration of the flare exceeds 14 min. One may notice a small decrease of the emission of the star during about 70 s which took place before the flare.

The slow rise of the flare on 26 August starts at about $19^{h}13^{m}$(Figure 2). After ~ 2 m the brightness rose sharply during about 20 s. The slow decline is observed during about $3^{m}40$ß. Then observation was interrupted for sky background measurement. Observations resumed after about 10 m, when the star was at quiescent state.

The flare on 4 September has a composite nature (Figure 3). There is a short spiky preflare at $18^{h}47^{m}30^{s}$. The main flare started ~ 10 s later and lasted ~ 20 s. It consists, probably, of a few spiky flares. The central part of the light curve of the preflare and main flare is presented in Figure 4. About 2 m later two small and short flares are seen in U. However, their presence in B is not certain. Generally some of the spikes in U are not certainly seen in B due, probably, to their relative faintness, they are smaller of the 3σ level.

In Table 2 the following parameters of the detected flares: the date of the flare, the flare magnitudes ΔU and ΔB, the $(U-B)$ color of the star at the peak of the flare, and the total duration of the flare are given.

Table 2: The parameters of the EV Lac flares.

Date	ΔU	ΔB	$(U-B)$	Total duration
23 Aug 2000	$3^{m}.1$	$1^{m}.1$	$-1^{m}.20$	$14^{m}10^{s}$
26 Aug 2000	$1^{m}.6$	$0^{m}.8$	$-0^{m}.05$	$> 4^{m}$
04 Sep 2000†	$1^{m}.9$	$0^{m}.6$	$-0^{m}.55$	$\sim 1^{s}$
04 Sep 2000	$2^{m}.5$	$0^{m}.7$	$-1^{m}.05$	$0^{m}20^{s}$

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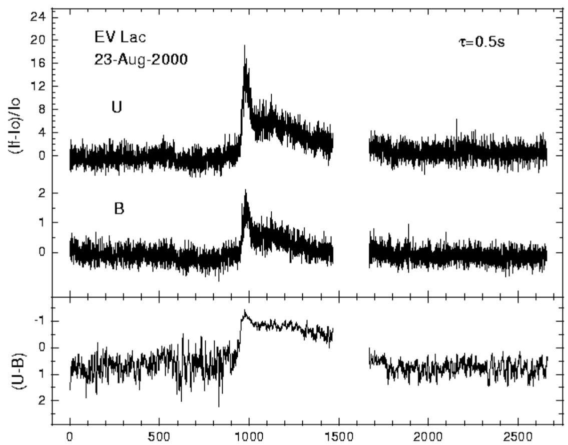

Figure 1. The flare of EV Lac on 23 August 2000. In the gap of the light curve the sky background was measured.

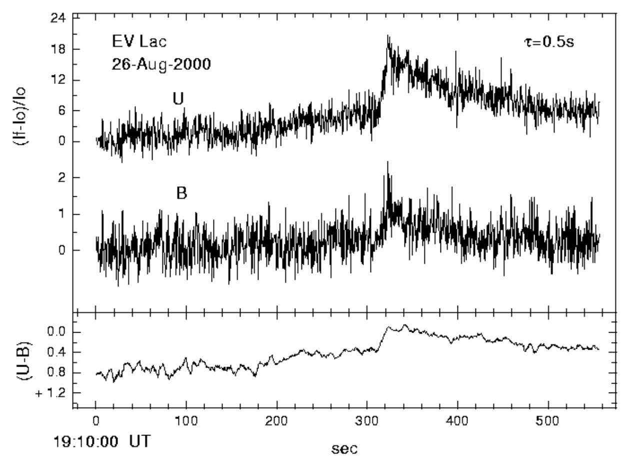

Figure 2. The flare of EV Lac on 26 August 2000.

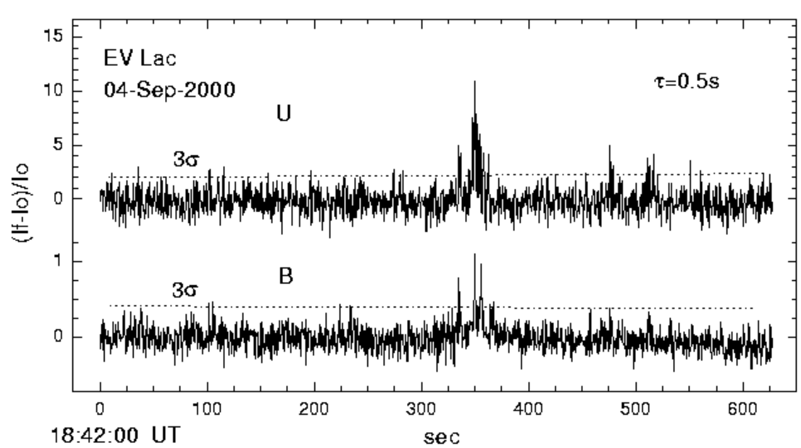

Figure 3. The flare of EV Lac on 4 September 2000. It consists, possibly, of a few spiky flares.

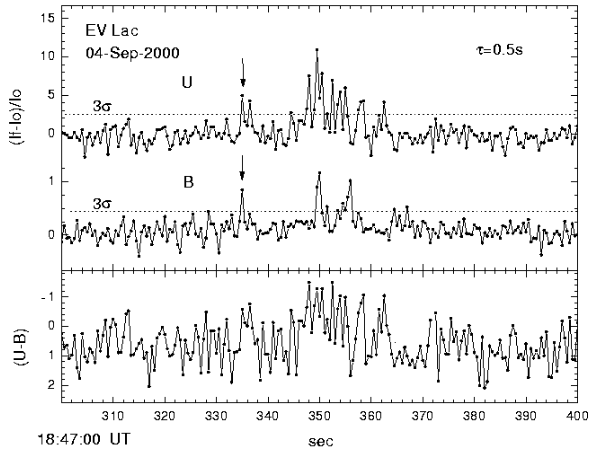

Figure 4. The light curve of the main flare of EV Lac on 4 September 2000 with higher resolution.

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GSC 4686 2315: A SHORT-PERIOD ALGOL

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In December 2000 while conducting a period study of the asteroid (391) Ingeborg , Koff used GSC 4686 2315 as a comparison star. During one 5 hour period GSC 4686 2315 faded by more than one magnitude. Observations on subsequent nights allowed for the determination of a preliminary period of 0.9 day. Assistance was sought by way of an Internet mailing list, and the Eclipsing Binary Team of the AAVSO joined the investigation.

Henden used the USNO 1.0-m telescope with an SITe 1024×1024 thinned, backside illuminated CCD and standard Johnson-Cousins BVR_cI_c filters along with Landolt standards to determine standard magnitudes for the variable and the comparison stars. These data are in Table 1 and the errors in the last decimal place are given in parenthesis. GSC 4686 2077 was chosen as the comparison and GSC 4686 2303 as the check star. Astrometry is based on the USNO-A 2.0 and has less than 100 mas internal errors.

Table 1. Standard magnitudes and color indices

GSC	RA (J2000)	Dec (J2000)	V	$B-V$	$V-R_c$	R_c-I_c
4686 2315	01:51:05.93	−3:32:40.90	13.769(2)[1]	0.948(5)	0.547(4)	0.533(5)
			14.633(5)[2]			
			13.822(4)[3]	0.949(9)	0.544(6)	0.48(1)
4686 2077	01:51:00.90	−3:28:58.47	14.352(6)	0.390(2)	0.242(6)	0.266(9)
4686 2303	01:51:01.39	−3:31:53.87	12.518(1)	0.688(3)	0.410(2)	0.416(3)

[1] Phase 0.28
[2] Primary min.
[3] Secondary min. at phase 0.51

More complete photometric information about all stars within 5 arcmin of the variable can be found in file 5257-t1.txt at the IBVS web site.

Koff initially used his 0.20-m SCT + Cookbook 245 CCD unfiltered with later follow up observations done with an SBIG ST-6 CCD unfiltered. Kaiser used his 0.35-m SCT + ST-9E CCD + V filter. Lubcke observed with his 0.28-m SCT + ST-9E CCD + V filter. A total of 6 times of minimum were obtained which are listed in Table 2.

Table 2. Times of primary minimum

HJD (error)	Observer	Epoch	$O-C$
2451910.7266 (1)	AAH	−1	0.000
2451911.6640 (5)	RAK	0	0.001
2451911.6631 (2)	AAH	0	0.000
2451927.5733 (2)	GCL	17	−0.002
2452155.9596 (3)	RAK	261	0.000
2452201.8232 (3)	RAK	310	0.000

The CCD times of minimum were determined with the software AVE (Barbera 2000) based on the Kwee & Van Woerden method (Kwee - Van Woerden 1956). A least squares solution gives the result of elements:

$$\text{Min. I} = \text{HJD } 2451911.6628 + 0^{\text{d}}.936002 \times E.$$
$$\pm 0.0005 \pm 0.000003$$

All data are phased to these elements and the combined light curves are shown in Figure 1.

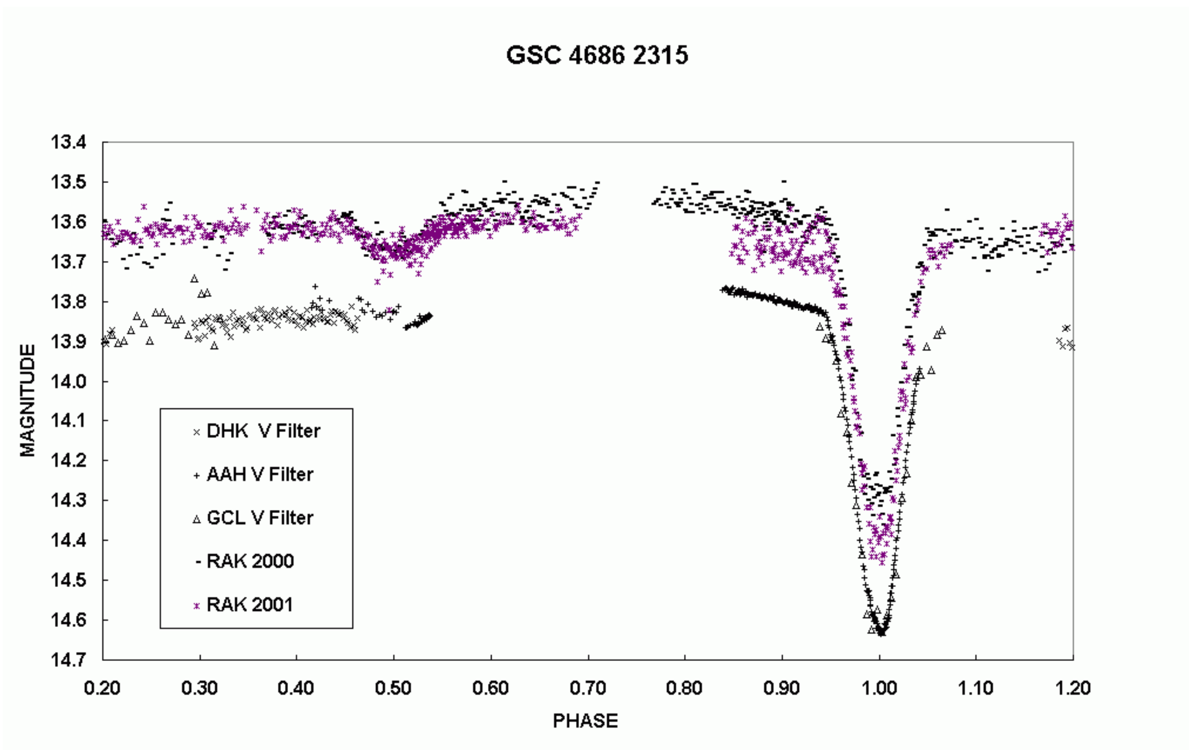

Figure 1. Combined unfiltered and V filtered light curve GSC 4686 2315.

The light curve reveals that the system is a short-period Algol. The unfiltered data cover two observing seasons and indicate that there are asymmetries in the light curve on that timescale, typical of migrating spots. However, the light curve is also consistent with the case of episodic mass transfer from the lobe-filling secondary with subsequent impact on the surface of the detached primary. This situation would result in a brightening of the system in the maximum preceding the primary eclipse, which is the case in the unfiltered light curve from 2000. The unfiltered light curve from 2001 shows the system in a state of quiescence with the outside-eclipse variations mainly due to the reflection effect. Multi-band photometry (especially at H_α) and spectroscopy during times of enhanced maxima would settle the question.

Observations in and around secondary minimum show large variations from one night to another, variations nearly as large as the eclipse depth itself in the V filter. Because the unfiltered observations have an effective wavelength longer than the V filter, the secondary eclipse is deeper than for the V data and this effect is not as striking. This variation is most likely due to the stochastic nature of the mass transfer, with quiescent periods resulting in a well-behaved secondary eclipse note the V light curve data after phase 0.5 which were taken during the night of JD 2451905) and active periods resulting in a disturbed eclipse (note the data leading up to phase 0.5 which were taken on the nights of JD 2451933 and JD 2451963). Supporting this hypothesis is the fact that the active-period data have a larger scatter than the quiescent-period data, indicative of a mass transfer event.

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THE FIRST GROUND-BASED PHOTOMETRY OF CONTACT BINARIES FN Cam AND EX Leo

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FN Cam (HD 46005, HIP 79886, $9^h22^m58\overset{s}{.}0$, $+77^\circ13'10''\!.9$, 2000.0, $V_{max} = 8\overset{m}{.}58, V_{min} = 9\overset{m}{.}05$) is one of the systems discovered by the Hipparcos mission (ESA, 1997). In the Hipparcos catalogue it is classified as a contact binary of F2 spectral type with the following ephemeris for the primary minimum:

$$\text{Min I} = 2\,448\,500.427 + 0.677128 \times E. \tag{1}$$

EX Leo (HD 93077, HIP 52580, $10^h45^m06\overset{s}{.}8$, $+16^\circ20'15''\!.7$, 2000.0, $V_{max} = 8\overset{m}{.}27, V_{min} = 8\overset{m}{.}49$) is another system discovered by Hipparcos and classified as a β Lyrae variable of F5 spectral type with the following ephemeris for the primary minimum:

$$\text{Min I} = 2\,448\,500.008 + 0.408604 \times E. \tag{2}$$

Both systems were observed spectroscopically. For FN Cam Rucinski et al. (2001), determined $q = K_1/K_2 = 0.222\pm0.005$ and $(m_1 + m_2)\sin^3 i = 2.496\pm0.069$ M$_\odot$ and gave two estimates of the spectral type: A9 and F2. For EX Leo Lu et al. (2001) determined $q = 0.199\pm0.004$ and $(m_1 + m_2)\sin^3 i = 1.255\pm0.036$ M$_\odot$ and F6V spectral type. Both

Table 1: New times of the primary (I) and secondary (II) minima. The standard errors of the minima are given in parentheses. The (O-C) residuals are given with respect to the Hipparcos ephemerides

	JD$_{hel}$ 2 400 000+	type	$(O-C)$
FN Cam	52292.3670(5)	I	0.0232
	52304.5563(2)	I	0.0242
	52307.2611(7)	I	0.0205
	52310.3107(3)	II	0.0230
EX Leo	52309.6134(5)	II	−0.0140
	52320.4419(1)	I	−0.0135
	52321.4647(2)	II	−0.0122

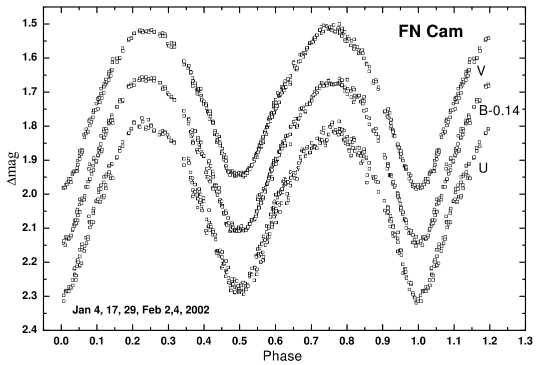

Figure 1. The UBV light curves of FN Cam relative to HD78846. The UB observations were shifted for clarity and phased according to ephemerides (3).

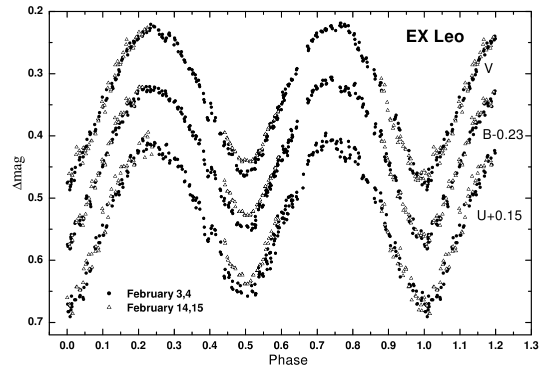

Figure 2. The UBV light curves of EX Leo relative to HD92511. The UB observations were shifted for clarity and phased according to ephemerides (4)

systems were classified as A-type contact binaries. Apart from the Hipparcos photometry no photoelectric or CCD light curve of the systems has been published.

Photoelectric light curves were obtained at the Stará Lesná and Skalnaté Pleso observatories of the Astronomical Institute of the Slovak Academy of Sciences. FN Cam was observed during 6 nights on January 4, 17, 29 and February 1, 2, 4, 2002 and EX Leo during 4 nights February 3, 4, 14, 15, 2002. At both observatories 0.6-m Cassegrain telescopes equipped with a single-channel photoelectric photometer were used. The standard UBV filters were used for all observations. Data reduction, the atmospheric extinction correction and transformation to the standard UBV system were carried out in the usual way (see Pribulla et al., 2001). For all observations of FN Cam HD 78846 and HD 81282 were used as the comparison and check star, respectively. In case of EX Leo HD 92511 and HD 92648 were used. Both systems show small light-curve changes seen in the differences of maximum height of FN Cam and the changes of the secondary minimum of EX Leo (see Figure 1). All individual observations are available in file 5258-t3.txt and 5258-t4.txt .

Four new minima times of FN Cam (Table 1) determined using Kwee & van Woerden method (weight $w = 2$), together with Hipparcos JD_0 ($w = 1$) and time of the spectroscopic conjunction $T_0 = 2\,451\,351.1554$ ($w = 1$) determined by Rucinski et al. (2001) provide the new ephemeris:

$$\begin{array}{llll} \text{Min I} = \text{HJD } 2\,452\,292.3667 & + \ 0.6771320 & \times E, \\ \qquad\qquad\qquad\qquad\ \pm 12 & \qquad \pm 6 & \end{array} \tag{3}$$

In the case of EX Leo our three minima augmented by the Hipparcos JD_0 and the time of the spectroscopic conjunction $T_0 = 2\,451\,615.6025$ (Lu et al., 2001) provide the following ephemeris:

$$\begin{array}{llll} \text{Min I} = \text{HJD } 2\,452\,309.4099 & + \ 0.40860258 & \times E. \\ \qquad\qquad\qquad\qquad\ \pm 3 & \qquad \pm 8 & \end{array} \tag{4}$$

The photometric elements were determined using the 1992 version of the Wilson & Devinney (1971) code. Due to a lower precision of the U observations only the BV data were used to determine the photometric elements. The mean temperature of the primaries

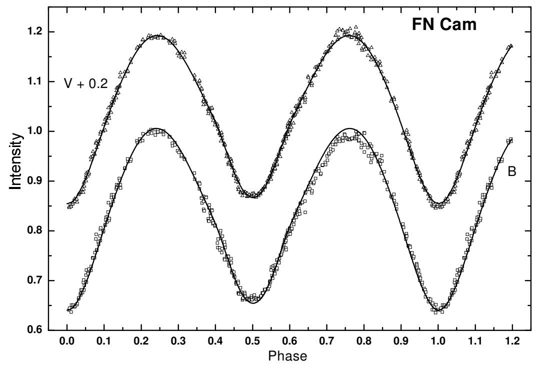

Figure 3. The best fits to the BV observations of FN Cam.

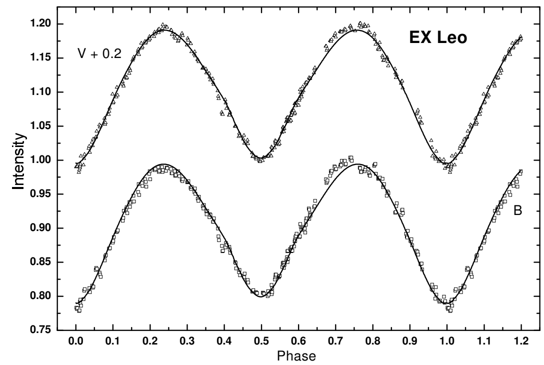

Figure 4. The best fits to the BV observations of EX Leo

Table 2: Photometric elements and their standard errors (given in parentheses). Fill-out is defined as $F = \frac{\Omega_{inn}-\Omega}{\Omega_{inn}-\Omega_{out}}$). Parameters not adjusted in the solution are denoted by a superscript "a"

Parameter	**FN Cam**	**EX Leo**
i [°]	71.2(2)	61.1(1)
q	0.222^a	0.199^a
Ω	2.162(2)	2.190(2)
Fill-out	0.88(2)	0.31(2)
T_1 [K]	6700^a	6330^a
T_2 [K]	6848(11)	6167(13)
$L_1^B/(L_1^B + L_2^B)$	0.754(1)	0.825(1)
$L_1^V/(L_1^V + L_2^V)$	0.760(1)	0.823(1)

of FN Cam and EX Leo were set according to F2V ($T_1 = 6700$ K) and F6V ($T_1 = 6330$ K) spectral types using the calibration of Popper (1980). The limb and gravity darkening coefficients as well as bolometric albedos were fixed appropriate to the convective envelope as usual for contact binaries. The resulting photometric parameters are given in Table 2 and the corresponding fits to the BV observations of FN Cam and EX Leo are shown in Figure 2. The errors reported is Table 2 are underestimated due to the applied modelling code.

For FN Cam we excluded observations in the B passband in the phase interval $0.6-0.9$, where the light curve is depressed probably by the presence of spots. Although there seems to be an interval of constant light during the secondary minimum the system is certainly partially eclipsing. For $q = 0.222$ and $F = 0.88$ the total eclipses occur for inclinations $i > 76.^\circ73$. It is interesting to note that the O'Connell effect is of the opposite sign in the B and V passbands. That's why the attempt to improve the fit by introducing a spot on either of the components failed. The inclination angle combined with the spectroscopic elements leads to the following masses of the components: $m_1 = 2.40\pm0.06$ M$_\odot$ and $m_2 = 0.53\pm0.02$ M$_\odot$. It is interesting to note that the system is quite overmassive for its spectral classification.

Since the light curve of EX Leo seems to be variable, we analyzed only the observations performed on the first two nights with the full coverage of the light curve. The resulting masses of the components are: $m_1 = 1.56\pm0.04$ M$_\odot$ and $m_2 = 0.31\pm0.01$ M$_\odot$.

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ERRATA FOR ISSUES 4997 AND 5145

ERRATUM FOR IBVS 4997

The declination of V1823 Cyg is, of course, $+34°38'33''.6$ instead of the $+3°$... printed in the paper.

The Editors

ERRATUM FOR IBVS 5145

In IBVS 5145 the reference to the paper "Ben, A.J., 1943, *AN*, **11**, No. 3" is erroneous. The correct reference is:

P. Guthnick, H. Schneller, 1944, *Astronomische Abhandlungen (Ergänzungshefte zu den Astronomischen Nachrichten)*, **11**, 3.

The Editors

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GSC 1377-0969 (Brh V65), GSC 0477-0889 (Brh V100) AND GSC 0669-0674 (Brh V102) ARE NEW W UMa VARIABLES

(BAV Mitteilungen No. 150)

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The three stars described here result from a programme to discover and classify new variables on the edge of the northern Milky Way. A discussion of the first group of stars and a more detailed description of the programme is given by Bernhard & Lloyd (2000, Paper1). Further information and an up-to-date list of the variables can be found at `http://mitglied.tripod.de/KlausBernhard/index.html` .

The survey and follow-up observations by Bernhard were made using a 20-cm Schmidt-Cassegrain telescope with an unfiltered Starlight Xpress SX CCD camera, with a Sony ICX027B chip. Further details are given in Paper 1. The observations by Frank were made using a 30-cm flat-field camera and an OES-LcCCD11 camera with a Kodak KAF-400 chip. An IR cut-off filter was used for the later observations, those of Brh V100 and V102, but not for V65. The observations of Moschner were made using a 32-cm Ritchey-Chrétien telescope with an unfiltered SBIG ST9 CCD camera and Kodak KAF-0261E chip. All the detectors have a very broad response, peaking near 6000Å, giving approximate V to R-band magnitudes, depending on the colour of the star.

The magnitudes of the variables are determined relative to an ensemble of comparison stars and are then calibrated approximately with respect to one reference star with a GSC magnitude. In most cases small offsets have been applied to correctly align the data due to differences in the instrumental response.

GSC 1377-0969 = Brh V65 (Bernhard 2001a) ($08^{h}15^{m}46\overset{s}{.}8$ $+16^{\circ}21'57''$ 2000) was re-observed after the survey observations on six nights by Moschner and two nights by Frank in February 2001, and February and March 2002. The reference star used was GSC 1377-0370 ($V \approx 11\overset{m}{.}5$). Brh V65 has $b = 12.3$ and $r = 11.2$ in the USNO A2.0 catalogue, and $B_T = 12\overset{m}{.}2 \pm 0\overset{m}{.}2$ and $V_T = 12\overset{m}{.}3 \pm 0\overset{m}{.}3$ in the Tycho-2 catalogue. The light curve is almost sinusoidal so there is a possible uncertainty of a factor of two in the

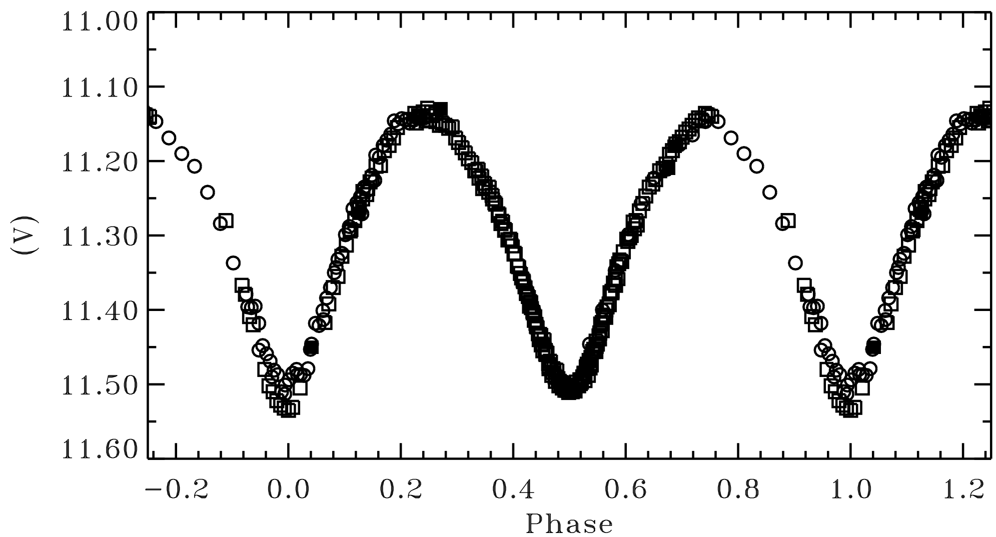

Figure 1. The phase diagram of GSC 1377-0969 = Brh V65 assuming that the reference star GSC 1377-0370 has $V = 11\overset{m}{.}5$. The CCD observations of Moschner (open squares), Frank (open circles) and Bernhard (filled circles) are folded with the ephemeris given in the text. No relative offsets have been applied to the major data sets.

Table 1: Brh V65 - Times of minima

HJD	$O-C$	Min	HJD	$O-C$	Min
2451955.3907(2)	+0.0003	II	2452321.3306(2)	−0.0001	II
2451956.3787(2)	−0.0007	II	2452338.3917(8)	+0.0002	I
2451964.2923(4)	+0.0007	II	2452342.3502(8)	+0.0026	I
2451968.4929(10)	−0.0021	I			

period from the photometry alone. However, an almost complete light curve has been observed by Moschner which shows a small difference in alternate minima. The most likely interpretation is that the star is a W UMa variable with almost identical eclipses. The colour, although poorly determined, the range of variation, $0\overset{m}{.}35$, and the galactic coordinates, $l = 207, b = +26$, are all consistent with this interpretation, and argue against it being a β Cephei or δ Scuti variable. In total seven eclipses have been observed and the times of minima (and errors) are given in Table 1. The light curve is shown in Figure 1 and the ephemeris of primary minimum is given by

$$HJD_{\rm MinI} = \underset{\pm 1}{2451968.495} + \underset{\pm 2}{0\overset{d}{.}494514} \times E.$$

GSC 0477-0889 = Brh V100 (Bernhard 2001b) ($19^{h}26^{m}28\overset{s}{.}1$ $+07°11'49''$ 2000, $l = 43$, $b = -4$) is classed as non-stellar in GSC 1.1 and 1.2 and does not appear in the USNO A2.0 catalogue, which does note a faint companion at 8″ with $r = 14.3$. The star does appear in GSC 2.2 with $b = 12.5$ and $r = 11.3$. Brh V100 was observed on 14 nights during the survey phase and on a further two nights by Bernhard and six nights by Frank, in August 2001. The reference star used was GSC 0477-1815 ($V \approx 11\overset{m}{.}1$). The period

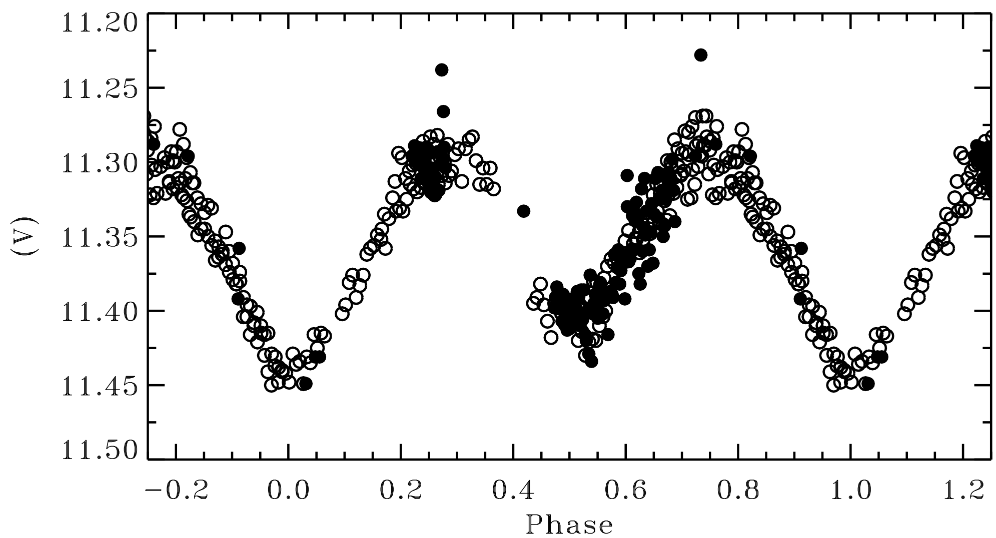

Figure 2. The phase diagram of GSC 0477-0889 = Brh V100 assuming that the reference star GSC 0477-1815 has $V{=}11\overset{\text{m}}{.}1$. The CCD observations of Frank (open circles) and Bernhard (filled circles) are folded with the ephemeris given in the text.

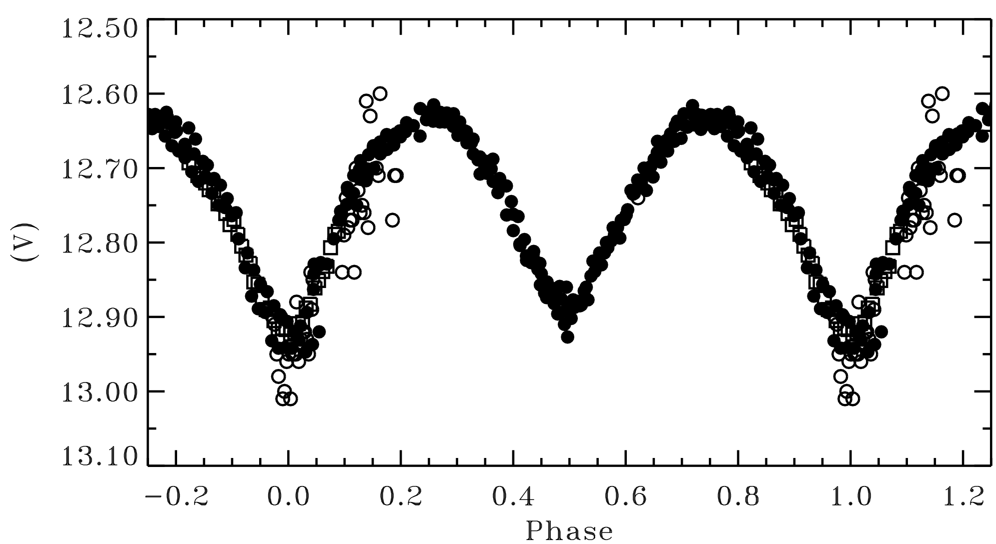

Figure 3. The phase diagram of GSC 0669-0674 = Brh V102 assuming that the reference star GSC 0669-0620 has $V = 12\overset{\text{m}}{.}0$. The CCD observations of Bernhard (open circles), Frank (filled circles) and Moschner (open squares) are folded with the ephemeris given in the text.

has been determined unambiguously and the resulting light curve is shown in Figure 1. The two minima are slightly unequal and suggest that the star is a W UMa variable. The amplitude of $0^{\rm m}_{.}15$ and the GSC 2.2 colour are at least not inconsistent with this interpretation. An almost complete light curve was observed by Frank which shows a small but clear difference in the eclipses. The ephemeris of primary minimum is

$$HJD_{\rm MinI} = \underset{\pm 2}{2452140.960} + \underset{\pm 6}{0^{\rm d}_{.}60926} \times E.$$

Following the initial observations by Bernhard (2002) GSC 0669-0674 = Brh V102 ($04^{\rm h}29^{\rm m}24^{\rm s}_{.}9$ $+09°05'31''$ 2000) was observed on a further night by Moschner and six nights by Frank, during January and February 2002. The reference star used was GSC 0669-0620 ($V \approx 12^{\rm m}_{.}0$). The period of Brh V102 has also been determined unambiguously and the star is also shown to be a W UMa variable with an amplitude of $0^{\rm m}_{.}3$. Frank observed a complete light curve and in this case there is a clear difference between the two minima. The galactic co-ordinates, $l = 186, b = -26$, are consistent with this interpretation. The $b - r$ colour from the GSC 2.2 and USNO A2.0 catalogues is 1.4 and 0.9 respectively, and while not well determined, is also consistent with the classification. Times of minima from six eclipses are given in Table 2. The ephemeris of primary minimum is

$$HJD_{\rm MinI} = \underset{\pm 1}{2452308.291} + \underset{\pm 3}{0^{\rm d}_{.}38786} \times E.$$

Table 2: Brh V102 - Times of minima

HJD	$O-C$	Min	HJD	$O-C$	Min
2452307.3195(9)	−0.0019	II	2452309.4592(14)	+0.0046	I
2452308.2914(7)	+0.0004	I	2452310.4216(11)	−0.0026	II
2452309.2610(6)	+0.0003	II	2452320.3142(4)	−0.0005	I

Acknowledgements. It is a pleasure the acknowledge the use of the SIMBAD database, operated by the CDS at Strasbourg, France.

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EMISSION-LINE FLARE OF ES 560B

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ES 560 (ADS 2594) is a visual double star with the separation of 9$''$.5. We observed it spectroscopically starting from 1996 to calibrate an orientation of the frame of the Multi-Pupil Field (Fiber) Spectrograph of the 6m telescope (MPFS, Afanasiev et al. 1996, `http://www.sao.ru/~gafan/devices/mpfs/`) during our investigation of stellar populations in the centers of nearby galaxies; later the brighter component of the double, ES 560A, which has a spectral classification of K2 (SIMBAD), was used by us as a line-of-sight velocity standard for cross-correlation with the galactic spectra. The spectra of ES 560B were not used but were still stored in the archive of our observational data. The detailed log of the observations of ES 560 with the MPFS is given in Table 1.

Table 1. Log of the spectral observations of ES 560 with the MPFS of the 6m telescope

Date	UT (start)	Exposure (s)	Detector	Spectral range
1996 Aug 17	00:50	180	CCD K585 520 × 580	4800–5600 Å
1996 Aug 18	01:14	180	CCD K585 520 × 580	4800–5600 Å
1996 Oct 10	03:19	180	CCD ISD017A 1040 × 1160	4100–5500 Å
1997 Nov 1	02:38	270	CCD K585 520 × 580	4700–5500 Å
1998 Jan 19	16:12	180	CCD K585 520 × 580	4700–5500 Å
2001 Jan 28	19:00	60	CCD TEK 1024 × 1024	4250–5600 Å
2001 Sep 22	01:58	240	CCD TEK 1024 × 1024	4250–5600 Å
2002 Mar 9	17:03	240	CCD TEK 1024 × 1024	4250–5600 Å

During our last observational run with the MPFS, in March 2002, we have exposed ES 560 as usually and have immediately seen that the spectrum of ES 560B has noticeably changed: now it contains strong narrow Balmer emission lines, Hβ with $EW = 13$Å and Hγ with $EW = 11$Å falling into our spectral range. Careful examination of the past spectra of ES 560B, starting from August 1996, has revealed an early presence of the very weak emission Hβ comparable to the noise; now its intensity has risen by more than an order. The full evolution of the spectrum of ES 560B in the spectral range of 4300–5450 Å is shown in Figure 1; all the continua are normalized to the same level and after

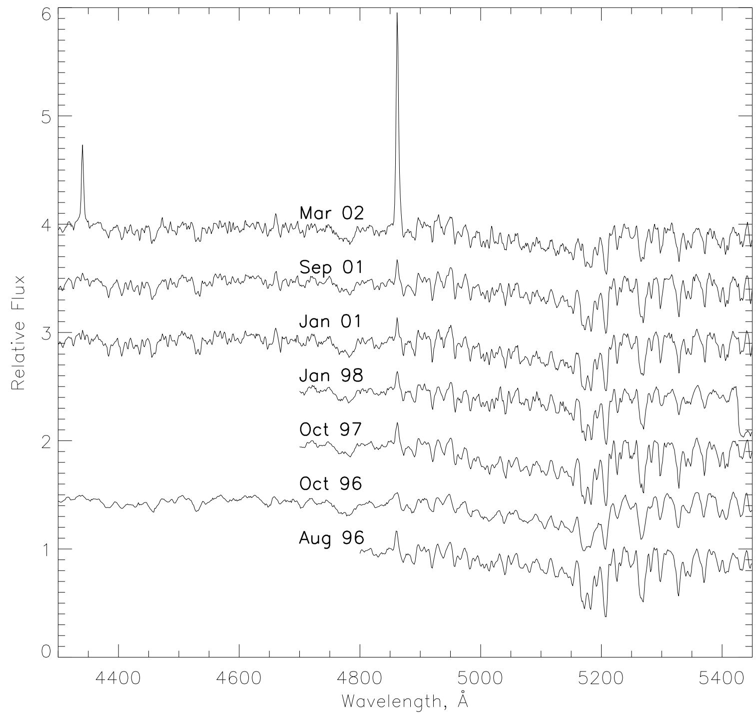

Figure 1. The evolution of the spectrum ES 560B from 1996 to present (two spectra of August 1996 are co-added); the continua are normalized and subtracted

that subtracted, and the shift along the ordinate axis for every spectrum is selected to provide a clear presentation.

Table 2. The ratio of brightnesses of two components of the double star ES 560

Date	$Flux_B/Flux_A$
1996 Aug 17	0.086
1996 Aug 18	0.076
1996 Oct 10	0.060
1997 Nov 1	0.048
1998 Jan 19	0.047
2001 Jan 28	0.115
2001 Sep 22	0.187
2002 Mar 9	0.037

By using SIMBAD, we have made cross-identification of ES 560B over some catalogues. The star is mentioned as V 577 Per by Kazarovets et al. (1999) in their $74^{\rm th}$ list devoted to variable stars discovered by HIPPARCOS (the Hipparcos name of ES 560 is HIC 16563). A more close examination of their description shows that HIPPARCOS has presented a photometry of two the stars of the double system ES 560 **together**, and the summed magnitude varies by some 0.1 mag. What star is variable, ES 560A or ES 560B, has been still unknown. With our integral-field spectroscopy, we are able to calculate a ratio of the two star's fluxes; these ratios measured in the 100 Å -band centered at the wavelength of

5000 Å, from 1996 to March 2002, are presented in Table 2, and their typical accuracy is 0.003–0.005. One can see that the relative brightness of ES 560B varies by a factor of 5, the SIMBAD information about $V_A = 8\overset{m}{.}3$ and $V_B \approx 10\overset{m}{.}5$ being related rather to the close-to-high state of ES 560B. Since the summed magnitude, according to HIPPARCOS, varies by ~ 0.1 mag, and not by 1.5 mag as it would be if the brighter component changes its flux by a factor of 5, we should conclude that it is ES 560B that is the variable star. Interestingly, the bright flare of emission lines occurred some month later (March 9, 2002) than the maximum continuum brightness (September 22, 2001, according to Table 2). We can suggest that there is either a few month delay between the emission line and continuum brightening, or the two events are two independent short flares with fast evolution.

What may be the nature of the variable star ES 560B? Another result of the cross-identification of ES 560 over various catalogues is a finding that a bright extreme-ultraviolet source is related to this double system. Firstly, ROSAT WFC survey in the spectral range of 60–200 Å (Pounds et al. 1993), and later EUVE all-sky survey at the wavelength of 100 Å (Bowyer et al. 1994) have mapped a rather bright source near ES 560 – 2RE J033314+461549 and EUVE 0333+462. As the spatial resolution of both surveys is about one arcminute, it is impossible to identify the UV source with ES 560A or ES 560B unambiguously. Mason et al. (1995) made spectral observations of the optical counterparts of the ROSAT EUV sources, and have found weak emission activity in both stars: an emission line of CaII3933 with $EW = 0.3$ Å, but no Balmer emissions, in ES 560A and an emission line Hα with $EW = 2$Å in ES 560B; the latter star is classified by them as dMe. The possibility that ES 560B is a flaring late-type dwarf may explain the most phenomena described here; however it is somewhat strange that a rather bright ($V \approx 10.5$) nearby flaring star has not been discovered yet.

We thank Profs. N.N. Samus and M.M. Katsova for the very helpful discussions of this work in the field quite new for us. This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France.

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V893 Sco IS NOT AN ER UMa-TYPE STAR

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V893 Sco is a recently rediscovered bright dwarf nova (Kato et al., 1998). The star was subsequently found to be an eclipsing dwarf nova below the period gap (Thorstensen, 1999; Matsumoto et al., 2000; Bruch et al., 2000). Most recently, Mason et al. (2001) proposed an idea that V893 Sco is an ER UMa-type dwarf nova. From their analysis of the evolutionary state of V893 Sco, Mason et al. (2001) proposed that all ER UMa stars may be newly formed cataclysmic variables (CVs).

ER UMa stars are a class of SU UMa-type dwarf novae (for a recent review of SU UMa-type dwarf novae, see Warner, 1995), whose known members are ER UMa, V1159 Ori, RZ LMi, DI UMa and IX Dra (Kato, Kunjaya, 1995; Robertson et al., 1995; Nogami et al., 1995; Kato et al., 1996a; Ishioka et al., 2001). ER UMa stars are known to show extremely short (19–50 d) supercycles (intervals between successive superoutbursts), short intervals (3–5 d) between normal outbursts, low amplitudes of superoutbursts (<3 mag), and extremely large (0.30–0.45) duty cycles of superoutbursts (see folded figures in Robertson et al., 1995; Kato, 2001). A comparison of basic parameters of ER UMa stars can be found in Table 1 of Kato et al. (1999). ER UMa stars are also known to show large-amplitude superhumps during the earliest or rising stage of an superoutburst (Kato et al., 1996b).

Mason et al. (2001) analyzed the light curve from VSNET[1], and identified outburst intervals of ∼30 d as being a supercycle and normal outburst with amplitudes of <1 mag every few days. Here we report an argument against this interpretation.

First, a supercycle of ER UMa-type dwarf novae is largely occupied by a long-lasting superoutburst (Kato et al., 1999). In contrast to the usual duty cycle (0.30–0.45) of superoutbursts in ER UMa stars, the outbursts of V893 Sco, which occur every ∼30 days, last only less than a few days (see Figure 1), and amount to a duty cycle of only ∼0.1. Furthermore, no superhumps, which are always seen during ER UMa-type superoutbursts, have yet been observed during these outbursts (S. Kiyota, private communication). The observations on 1999 May 12 and 13 by Matsumoto et al. (2000) were done during a rise of such an outburst, and no signature of superhumps was observed, in spite of the fact that all known ER UMa stars exhibit strong superhumps even during the rise to superoutburst (Kato et al., 1996b). These outbursts bear all characteristics of normal outbursts rather than those of superoutbursts.

[1] http://www.kusastro.kyoto-u.ac.jp/vsnet

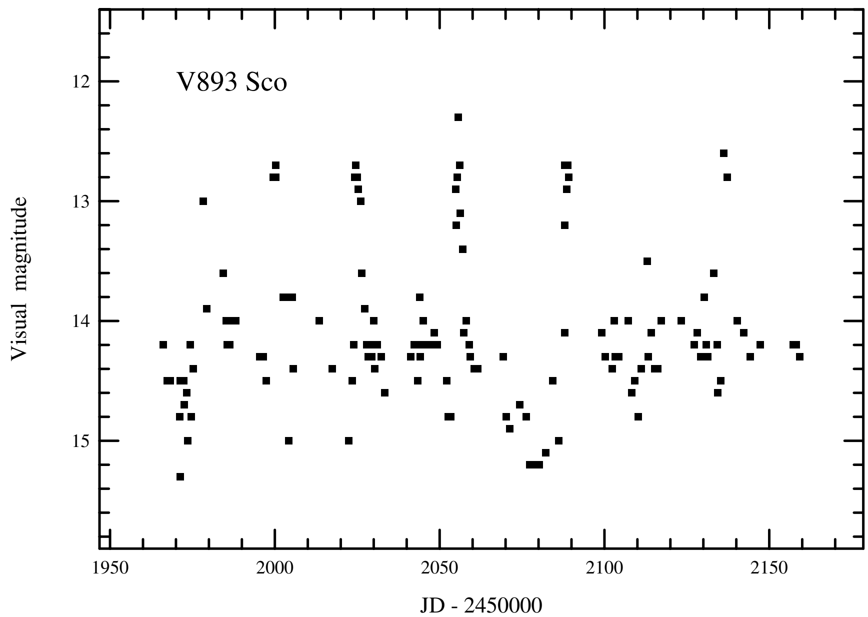

Figure 1. Representative long-term light curve of V893 Sco from visual observations reported to VSNET.

Secondly, what were referred to as possible minioutbursts (<1 mag) every few days in Mason et al. (2001) are not evident as shown in Figures 1 and 2. Both visual and CCD observations show only *irregular* variations which are frequently met in CVs. Furthermore, normal outbursts of ER UMa have amplitudes of ~2 mag (Figure 2, lower panel), which are significantly larger than the variation seen in V893 Sco. The presence of quiescent variations in V893 Sco had also been independently discovered and discussed by Bruch et al. (2000). Bruch et al. (2000) found a variation up to 0.5 mag from one orbit to next. The amplitude of this variation is quite comparable to the one described in Mason et al. (2001). Furthermore, the time scale of this variation is an order of an orbit (~0.076 d), which is far shorter than the time scales of dwarf-nova outbursts. As pointed out by Bruch et al. (2000), the short-term variations of V893 Sco in some aspects bear similarity to those of OY Car and Z Cha (cf. Cook, Warner, 1984; Wood et al., 1989). These variations may therefore be better understood as an enhanced activity sometimes observed in high-inclination systems (Kato et al., 2001) and references therein.

From these findings, we conclude that V893 Sco bears no similar characters with ER UMa star, and that the argument in Mason et al. (2001) according to which V893 Sco provides evidence that all ER UMa stars may be newly formed CVs needs to be reconsidered.

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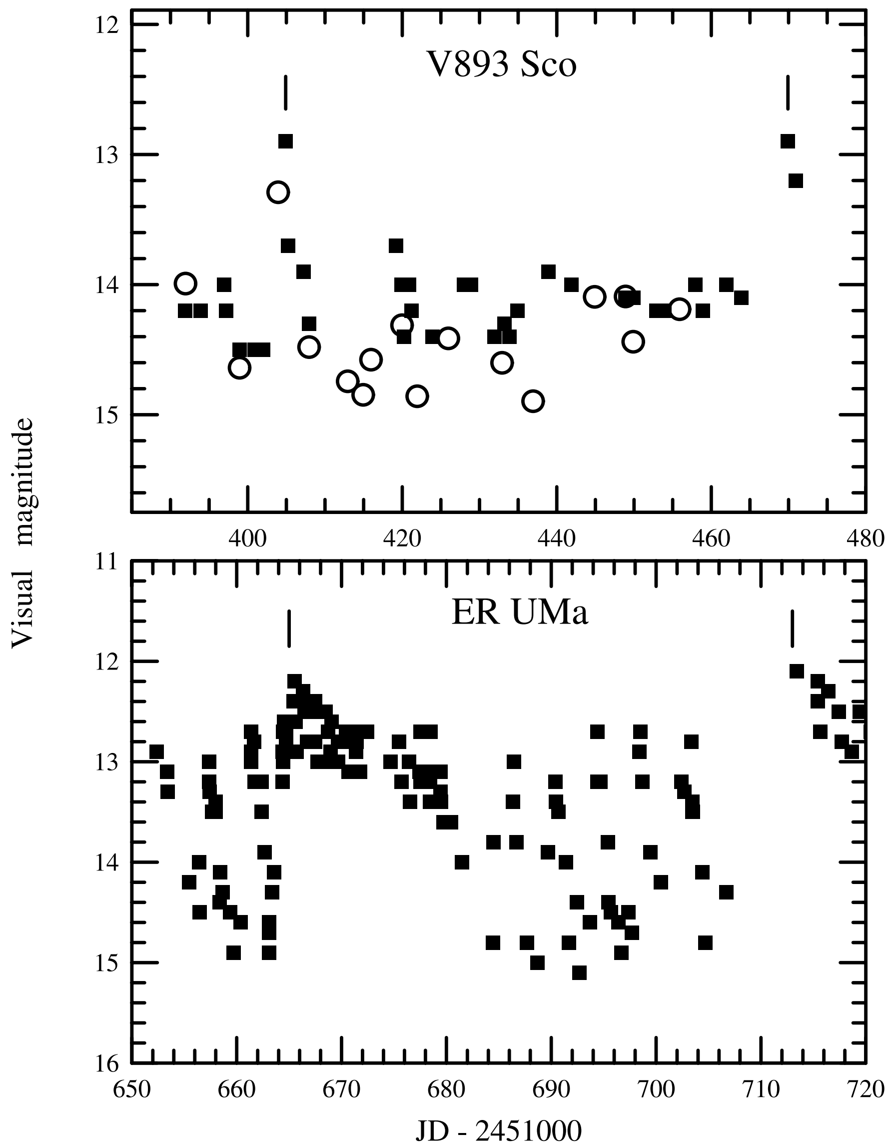

Figure 2. Comparison of light curves between V893 Sco (upper) and ER UMa (lower). Filled squares and open circles represent visual observations by VSNET observers and CCD observations by the authors. CCD observations were carried out using a 25-cm Schmidt-Cassegrain telescope and an ST-7 CCD. The zero-point adjustment was made using Kiyota's CCD observation (private communication). The typical errors of observations are 0.2 mag (visual), 0.1 mag (CCD). The light curve of V893 Sco is strikingly different from that of ER UMa in that it completely lacks long-lasting superoutbursts (ER UMa, marked with ticks) and frequent short outbursts between superoutbursts.

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CCD TIMES OF MINIMA OF FAINT ECLIPSING BINARIES III

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Observatory and telescope:
16″Newtonian telescope (f/1750 mm) at N. Copernicus Observatory and Planetarium in Brno

Detector:	CCD camera SBIG ST-7, Peltier cooling, KAF1600 chip, $9' \times 13'$ FOV, 255×382 pixels.

Method of data reduction:
Reduction of the CCD frames was made with a software package Munidos [1] .

Method of minimum determination:
The minima times were computed using several procedures written by A. Gaspani (1995) based on artificial neural networks.

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
UU And	EA/SD	00 43 45	+30 56 20	2275.0851 †	41650.340	1.486296	1
LM And	EB/SD	02 11 09	+48 51 35	3289.1989	43837.496	0.76123	1
UU Aqr	SR	22 09 06	−03 46 18	5227.0328	46347.2667	0.163579089	2
GK Aqr	EW/KW	22 19 57	−00 39 47	5225.1106	45233.292	0.3274097	3
V416 Aql	EA/SD	19 33 39	+00 32 23	0478.2264	25535.322	1.338052	1
V631 Aql	EA/SD	19 35 46	+12 03 24	0975.15535423	29163.326	1.155125	1
V770 Aql	EA/SD:	20 03 09	+09 50 15	1076.0483	28746.408	1.59289	1
V784 Aql	EW/KW	20 07 07	+13 29 59	1084.1623	51465.3278	0.587680	4
V873 Aql	EW/KW:	18 45 01	+00 34 04	0447.0372	38651.325	0.3575706	1
V919 Aql	EB/KE:	19 22 56	−01 02 32	5131.1016	35369.358	0.797102	1
V1355 Aql	EB	19 33 52	+15 56 28	1601.1550	35428.2445	0.5157965	1
EQ Aur	EA/SD:	06 50 27	+35 21 47	1200.05182374	28835.440	3.42958	1
FW Aur	EA/SD	05 52 10	+30 12 44	2406.0277	29335.274	2.55997	1
HU Aur	EB/KE	04 39 04	+34 39 24	2381.1365	26707.370	1.408010	1
QT Aur	IS:	06 16 28	+39 53 24	2930.1174	39026.554	1.0895	5
V364 Aur	E	05 30 27	+46 20 15	3359.1354	38849.342	0.69903	5
V379 Aur	EA/SD	06 21 30	+41 51 01	2935.2663	39026.564	1.351036	5
TU Boo	EW/KW	14 04 58	+30 00 01	2545.1000	50182.4799	0.3448733	1
TY Boo	EW/KW	15 00 47	+35 07 54	2568.0991	45768.624	0.418034	1
AC Boo	EW/KW	14 56 28	+46 21 44	3474.0835	29111.508	0.960271	1
AR Boo	EW/KW:	13 48 10	+24 55 28	0199.0233	50182.4799	0.3448733	6

[1]Hroch, F., Novák, R., 1997, MUNIDOS, `http://munipack.astronomy.cz/`

†The names of the comparison stars are from the GSC and USNO A2.0 respectively

Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
XZ Cam	EA/DS	05 17 13	+75 50 06	4511.0514 †	45449.6	0.7396	1
AQ Cam	EA/SD	04 51 18	+54 56 01	3737.1283	42950.490	2.4642074	1
RY Cnc	EA/SD	08 39 55	+19 49 18	1395.2057	51427.4063	0.610510	1
TY Cnc	EA/SD	08 47 10	+08 24 25	0810.0036	51375.4528	0.404194	1
AE Cnc	EA/SD	08 48 07	+09 10 21	0810.2160	50895.5095	2.315268	1
EH Cnc	EW/KW	08 26 18	+20 52 50	1391.1356	45768.624	0.418034	7
YZ CVn	EA/SD	13 56 49	+28 44 20	2005.0526	29111.508	0.960271	1
AO CMi	EA/SD	07 10 04	+01 58 29	0167.0352	45241.471	0.4728289	1
AL Cas	EW	02 13 50	+70 09 01	4315.0452	45449.6	0.7396	1
KT Cas	EA/SD	01 04 44	+54 07 04	3668.1279	42950.490	2.4642074	1
MM Cas	EA/SD	00 54 31	+54 26 16	3672.0189	51427.4063	0.610510	1
MR Cas	EW/KW	00 11 33	+58 05 41	3660.0114	51375.4528	0.404194	1
MS Cas	EA/SD	00 11 54	+60 06 35	4014.1509	50895.5095	2.315268	1
V345 Cas	EB/SD:	23 08 37	+54 08 16	1425.14652972	51876.534	0.358519	1
V364 Cas	EA	00 52 43	+50 28 11	3270.0096	37647.022	1.016412	1
V851 Cas	EA:	23 38 10	+53 42 37	1425.15346136	29111.508	0.960271	8
IM Cep	EB	23 13 09	+62 41 56	4283.0363	29931.265	0.921589	1
V358 Cep	EB/KW	02 27 26	+81 10 13	4507.0232	45241.471	0.4728289	9
CC Com	EW/KW	12 12 06	+22 31 55	1986.1673	39533.5830	0.22068628	1
DD Com	EW/KW	12 28 46	+21 43 25	1447.1638	37779.410	0.2692061	1
DG Com	EB/SD	12 30 10	+20 59 26	1447.2432	37795.500	0.986615	1
EQ Com	EB	12 58 52	+18 00 49	1453.0621	37705.584	0.361867	1
GM Cyg	EA/SD	20 04 16	+38 07 46	1275.13264384	32408.522	4.745802	1
KV Cyg	EB/SD	20 15 38	+36 47 40	2684.1856	29468.389	2.8389936	1
PW Cyg	EA	19 56 32	+39 30 35	1275.12823576	32256.665	2.021779093	1
QS Cyg	E/KE	19 57 40	+38 48 21	3137.1978	23730.358	1.044000	1
QU Cyg	E	19 58 28	+38 13 30	3137.3455	24026.509	0.3469103	1
QX Cyg	E/DW	19 58 35	+38 14 36	1275.12938182	23352.335	0.89961	1
V454 Cyg	EB/SD	20 15 57	+37 30 29	2684.0631	28725.469	2.3168937	1
V484 Cyg	EA/SD	20 00 41	+35 14 20	2678.0746	28097.376	1.293825	1
V502 Cyg	EW	20 26 28	+42 41 37	3160.0134	38299.309	0.566958	1
V681 Cyg	EA	21 55 26	+48 29 28	3608.0824	25911.530	3.40429	1
V693 Cyg	EA	20 07 47	+39 43 59	1275.13438660	32647.7865	1.1347738	1
V704 Cyg	EW	21 28 12	+45 37 38	3590.0282	37939.409	0.570704	1
V706 Cyg	EB	21 35 55	+40 50 34	3187.1613	40116.429	0.46625592	1
V711 Cyg	EA/SD	21 51 16	+48 02 48	1350.15107073	32802.447	0.826757	1
V842 Cyg	EA/SD	19 22 58	+27 46 03	2132.0135	35391.312	0.8591372	1
V865 Cyg	EW/KW	19 27 24	+33 03 09	1200.11599656	34238.2430	0.36530095	1
V880 Cyg	EA/KE:	19 31 27	+33 39 20	1200.11885216	33857.404	1.0600316	1
V906 Cyg	EW/KW	19 34 57	+34 38 40	1200.12133312	31962.5859	0.365166713	1
V907 Cyg	EW/KW	19 35 30	+29 45 48	2150.1562	39029.450	0.426056	1
V931 Cyg	EW/KW	19 39 14	+29 46 09	2150.1262	34134.4975	0.34149157	1
V961 Cyg	EA	19 43 58	+32 52 16	2660.2383	34237.401	2.0378068	1
V963 Cyg	EA/DW:	19 44 06	+31 41 52	2656.2509	34629.397	0.69733397	1
V970 Cyg	EB	19 44 56	+28 15 19	2151.4375	35317.509	0.5209495	1
V1004 Cyg	EB	19 50 29	+33 08 41	2673.0440	34626.437	0.68569997	1
V1010 Cyg	EA	19 53 45	+29 34 29	2152.0476	32764.524	2.4069968	1
V1047 Cyg	EA/SD	20 17 42	+52 57 24	3937.1903	27368.392	0.929658	1
V1048 Cyg	EA/SD	20 23 07	+52 32 44	3937.2045	27692.516	0.742224	1
V1130 Cyg	EA/SD	19 34 04	+39 42 43	3139.0735	32821.8019	0.562561247	1
V1321 Cyg	EA	20 23 35	+41 31 45	3160.0571	36808.378	0.3640901	1
V1414 Cyg	EA/SD	22 01 20	+47 36 11	3609.2600	29112.380	0.703126	1
V1580 Cyg	EA/SD	19 44 10	+45 27 29	1350.10973430	42653.610	1.811443	1
V1787 Cyg	EA	20 37 47	+55 16 29	3954.0991	45449.6	0.7396	10
V1908 Cyg	EA/SD	21 31 39	+33 49 53	2712.2594	42950.490	2.4642074	11
V2239 Cyg	EA	20 15 18	+37 31 44	2684.0631	51427.4063	0.610510	12
V2240 Cyg	EW	20 15 56	+37 27 16	2684.0631	51375.4528	0.404194	13
BI Del	EA/SD	20 27 38	+14 20 10	1099.0251	50895.5095	2.315268	1

† The names of the comparison stars are from the GSC and USNO A2.0 respectively

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
BO Del	EA/SD	20 39 18	+14 22 38	0975.19384585†	51876.534	0.358519	1
Z Dra	EA/SD	11 45 29	+72 14 56	4396.1221	37647.022	1.016412	1
TW Dra	EA/SD	15 33 51	+63 54 24	4184.0387	43069.903	0.470681	1
XY Dra	EA/SD	18 18 16	+55 03 30	3908.1350	50895.5095	2.315268	14
TZ Gem	EA/SD	06 37 36	+19 36 17	1337.0335	28495.75	1.6777103	1
AV Gem	EA/SD	06 42 01	+13 24 45	0758.1933	27832.6099	1.2216548	1
EG Gem	EA/SD	06 57 51	+13 08 32	0760.1254	27344.635	1.273392	1
GM Gem	EA	07 05 31	+10 38 23	0753.1814	30375.535	1.35967	1
HR Gem	EA/SD	06 12 17	+24 42 13	1881.1349	30319.688	1.068963	1
KQ Gem	EB/KW	06 43 50	+15 53 56	1330.1192	29231.515	0.4079925	1
KV Gem	RRC:	06 47 12	+15 43 17	1330.0101	51876.534	0.358519	4
AM Her	AM/XRM+E	18 16 14	+49 51 56	3533.1026	43014.71266	0.128927	1
DH Her	EA/SD	18 47 33	+22 50 34	2108.1438	26575.456	4.779161	1
ES Her	EB/KE:	17 56 50	+32 54 42	2612.1184	44770.512	0.7820304	1
V502 Her	EW/KW	17 35 50	+32 19 10	2610.2196	30938.493	0.3692768	1
V643 Her	EA/SD	18 33 10	+23 22 44	2106.0840	36069.386	1.223110	1
V719 Her	RRC:	17 09 52	+42 56 07	3084.0570	41598.278	0.335870	1
DE Hya	EA/SD	08 27 47	+05 38 38	0209.0024	31149.151	4.227678	1
CG Lac	EA/SD	22 44 58	+49 06 54	3629.0902	29627.255	0.8193938	1
EX Lac	EA/SD:	22 41 04	+52 27 30	3632.3045	24795.53	1.739293	1
GH Lac	EA	22 39 35	+47 14 40	3624.0346	25423.506	0.532645	1
HW Lac	EA	22 05 42	+51 53 44	3617.0930	34011.340	2.0307782	1
HX Lac	EW	22 06 09	+49 32 09	3613.2498	25243.115	0.5274659	1
IP Lac	EA	22 08 09	+51 36 13	3618.0924	33861.525	0.8520105	1
KO Lac	EA/SD	22 14 31	+53 29 02	3982.2126	33206.445	1.0260728	1
LU Lac	EW/KW	22 21 42	+51 22 04	3619.3885	33513.5649	0.29880135	1
NR Lac	EB	22 29 21	+49 41 59	3615.0868	33873.638	0.6048038	1
NS Lac	EA	22 29 30	+49 59 41	3615.0269	34366.332	1.0155663	1
V344 Lac	EW/KW	22 18 47	+51 59 16	3618.2138	45222.5635	0.39222768	1
Y Leo	EA/SD	09 36 52	+26 13 58	1962.1299	45436.451	1.6861020	1
UU Leo	EA/SD	09 47 50	+12 59 09	0834.0945	45397.456	1.6797409	1
VZ Leo	EA/SD	09 26 49	+16 36 15	1403.0723	31164.316	1.089906	1
BL Leo	EW/KW	11 45 33	+24 46 20	1985.0975	44648.756	0.2819306	1
BW Leo	EW/KW	11 32 09	+17 19 26	1438.1475	38111.429	0.337221	1
CE Leo	EW/KW	11 44 03	+23 20 21	1985.1274	45047.4325	0.303429	1
AH Lyn	EA	08 42 18	+37 11 08	2490.0592	37647.022	1.016412	15
AH Lyr	EB/SD	19 13 01	+27 16 28	2131.0311	27845.436	1.0307101	1
DU Lyr	EB/D	19 03 50	+30 08 14	2640.1990	29784.470	0.83700	1
DZ Lyr	EA/SD	19 10 52	+27 07 01	2131.1067	25439.420	1.8364125	1
FH Lyr	EA/SD	19 11 28	+36 39 52	2650.0770	45554.400	1.589240	1
GZ Lyr	EA/SD	19 10 31	+27 55 11	2131.2932	38562.423	1.3294322	1
IP Lyr	EB	18 23 20	+33 10 38	2627.1309	44461.411	0.4728057	1
PY Lyr	EW/KW	19 20 26	+28 56 47	2136.1185	45119.418	0.3857582	1
V361 Lyr	E	19 02 31	+46 58 27	3545.2244	44523.307	0.309616	1
V401 Lyr	E	19 14 15	+38 26 58	3121.1353	38204.475	0.839361:	1
V404 Lyr	EB/SD:	19 19 06	+38 21 60	3121.1451	35836.462	0.73094585	1
TV Mon	EA/SD	06 28 23	+05 12 50	0141.1131	44225.475	4.179742	1
VX Mon	EA/SD	06 31 00	+09 18 21	0733.2665	25300.34	1.62967	1
AY Mon	EA/SD	06 53 17	+09 08 21	0975.0411	28247.464	2.144235	1
V532 Mon	EW:/KW:	07 04 30	−00 21 03	4814.1217	34769.3467	0.46698470	1
EG Ori	EA/SD	06 11 06	+16 19 12	1314.0765	25245.41	1.163166	1
FH Ori	EA/SD:	05 23 17	+04 16 46	0109.2499	25900.387	2.15116	1
GU Ori	EA	06 10 05	+12 49 22	0738.0513	43069.903	0.470681	16
QV Ori	EA	05 50 08	+19 58 50	1307.0821	30258.610	1.748815	1
V645 Ori	EA/SD	06 15 32	+15 33 58	1314.1673	28251.328	1.040442	1
V648 Ori	EA/DM	04 52 33	+06 19 26	0096.0705	25997.310	1.626468	1
BY Peg	EW/KW	21 38 55	+28 06 48	2201.0007	45565.518	0.3419372	1
CC Peg	E	21 39 42	+28 24 56	1125.18643667	24791.68	0.60563	1

†The names of the comparison stars are from the GSC and USNO A2.0 respectively

Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
CE Peg	E	21 40 51	+25 09 40	2193.1160 †	24789.60	0.64202	1
EY Peg	EA/SD	23 15 23	+16 46 58	1712.0522	36057.518	0.65678	1
WY Per	EA/SD	03 38 25	+42 40 41	2870.1440	46002.360	3.3271615	1
DK Per	EB/SD	02 23 47	+57 59 24	3694.0207	42492.373	0.898876	1
II Per	EB/KW	04 29 37	+44 25 32	2891.2911	30257.550	0.479854	1
QU Per	EA/SD	03 05 54	+40 39 35	2851.1285	36082.582	2.400936	1
V366 Per	EA/SD	02 44 09	+36 34 40	2337.0281	38642.608	1.4219831	1
DK Sge	EW	20 14 01	+21 22 09	1630.0513	35630.400	0.6218188	1
EI Sge	EW/KW	19 59 07	+19 27 56	1624.0174	36724.419	0.3882480	1
FL Sge	EA/SD	20 13 23	+18 28 19	1050.16885687	29071.474	2.09290	1
BI Ser	EA/SD:	15 56 01	+17 30 32	1499.0982	46264.414	1.204882	1
CX Ser	EA/SD:	15 23 35	+02 35 18	0341.0086	31213.490	0.9972918	1
AQ Tau	EA/SD:	04 55 58	+27 53 13	1840.0998	29651.774	1.215904	1
EN Tau	EA/SD:	05 56 42	+25 14 27	1867.0149	26003.435	1.239029	1
ES Tau	EA/SD	05 29 26	+28 45 56	1125.02463844	33184.38	0.909794	1
V407 Tau	EA/SD	04 10 56	+26 17 57	1822.0039	36522.267	2.051133	1
UX UMa	EA/WD+NL	13 36 41	+51 54 50	3469.0867	37432.8204	0.19667128	1
VV UMa	EA/SD	09 38 07	+56 01 04	3810.1515	45815.3365	0.687380	1
AW Vir	EW/KW	13 27 32	+03 02 28	0303.1038	45022.645	0.35399695	1
AX Vir	EB/KE	13 27 45	+03 52 28	0303.0397	27570.444	0.7025262	1
DY Vir	EA/SD	12 19 18	+09 22 21	0873.0348	38901.411	0.934280	1
AW Vul	EA/SD:	20 29 00	+24 48 03	2160.1359	46285.465	0.80645141	1
AX Vul	EA/SD:	20 33 08	+24 52 05	1125.16301707	44853.390	2.0248386	1
BG Vul	EW/KW	21 19 27	+22 03 25	1662.1576	24767.70	0.403252	1
BI Vul	EW/KW	21 22 49	+27 01 59	2195.1519	44757.9270	0.251818	1
BK Vul	EW/KW	21 25 24	+27 51 30	2195.2186	24767.70	0.45347	1
BM Vul	EW/KW	21 30 41	+25 08 02	2192.0646	24769.66	0.377052	1
BT Vul	EA	20 23 05	+27 28 36	2164.0245	35402.180	1.141200	1
FF Vul	E/KW	20 23 10	+25 43 42	2160.0239	35686.45	0.444986	1
FM Vul	EB/KE:	19 31 47	+27 08 03	1125.12974394	43755.409	0.7846407	1
FR Vul	EA	19 36 21	+26 45 51	2146.4529	34981.3980	0.94185866	1
GI Vul	EB	19 42 38	+26 38 28	2147.3108	35066.263	0.4814832	1
GV Vul	EA	19 49 23	+20 39 12	1050.15074394	27546.551	1.01482	1
NO Vul	EW/KW	19 34 40	+20 36 38	1609.1367	46346.311	0.3707685	1

Source(s) of the ephemeris:

1.: Kholopov et al., 1985; 2.: Goldader & Garnavich, 1989; 3.: Kurochkin, 1986; 4.: Zejda, 2001; 5.: Splittgerber, 1985; 6.: Wolf et al., 1998; 7.: Figer el al., 1985; 8.: Busch & Häussler, 1990; 9.: Diethelm, 1990; 10.: Locher, 1983; 11.: Zemljannikova, 1986; 12.: Šafář, 1999b; 13.: Šafář, 1999a; 14.: Šafář, this paper; 15.: Kinman et al., 1982; 16.: Samolyk, 1985

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
UU And	51449.5124	0.0025	I	–	0.0229	JŠ
LM And	51433.2645	0.0020	I	–	0.2156	MZ,JŠ; normal. min.
UU Aqr	51377.5295	0.0003	I	–	0.0422	JŠ
GK Aqr	51363.4798	0.0025	I	–	0.0960	JŠ
V416 Aql	51378.4241	0.0055	I	–	−0.0342	MZ; normal. min.
V631 Aql	51379.3987	0.0030	I	–	−0.4464	JŠ
V770 Aql	51378.4994	0.0038	I	–	0.3103	MZ
	51394.4286	0.0033	I	–	0.3106	MZ
V784 Aql	51399.5048	0.0033	II	–	0.0002	MZ; normal. min.
	51404.5000	0.0037	I	–	0.0047	MZ
	51465.3293	0.0022	II	–	0.0293	MZ
	51467.3831	0.0063	I	–	−0.0069	MZ

†The names of the comparison stars are from the GSC and USNO A2.0 respectively

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
V873 Aql	51331.5110	0.0015	I	–	0.0174	JŠ
	51394.4477	0.0028	I	–	0.0217	MZ
V919 Aql	51449.3166	0.0026	I	–	0.0200	JŠ
V1355 Aql	51392.4935	0.0025	I	–	−0.1685	JŠ
EQ Aur	51449.6017	0.0020	I	–	−0.4888	JŠ; normal. min.
FW Aur	51481.5307	0.0026	I	–	−0.0438	JŠ
HU Aur	51195.4578	0.0020	I	–	−0.0221	MZ
QT Aur	51258.4013	0.0021	I	–	0.0308	MZ; normal. min.
V364 Aur	51195.5263	0.0030	I	–	−0.0836	MZ; normal. min.
V379 Aur	51465.4789	0.0043	I	–	−0.0736	MZ; normal. min.
TU Boo	51272.4290	0.0020	I	–	−0.0845	MZ
TY Boo	51272.3590	0.0022	I	–	−0.0853	MZ; normal. min.
AC Boo	51374.4289	0.0028	I	V	−0.0089	MZ
AR Boo	51284.3511	0.0015	II	–	−0.0273	JŠ
	51277.4539	0.0025	I	–	−0.0486	JŠ
	51270.5551	0.0021	I	–	0.1369	JŠ
XZ Cam	51237.4878	0.0064	I	–	0.1064	MZ; normal. min.
AQ Cam	51535.3736	0.0060	I	–	0.0297	MZ
RY Cnc	51195.5711	0.0020	I	–	0.0378	MZ
	51241.4742	0.0030	I	–	0.0373	JŠ
TY Cnc	51193.4325	0.0140	I	–	−0.1857	MZ
AE Cnc	51193.5731	0.0019	I	–	−0.0446	MZ,DH; normal. min.
EH Cnc	51193.4883	0.0024	I	–	0.0371	MZ
	51241.3499	0.0030	II	–	0.0338	JŠ
	51284.4064	0.0023	II	–	0.0328	JŠ
	51270.4020	0.0026	I	–	0.0325	JŠ
YZ CVn	51288.3975	0.0019	I	–	−0.0065	MZ
AO CMi	51237.3167	0.0104	I	–	−0.0934	MZ; normal. min.
AL Cas	51433.5660	0.0024	I	–	−0.0099	JŠ
KT Cas	51449.4972	0.0030	I	–	−0.1172	JŠ
MM Cas	51484.5827	0.0028	I	–	0.0607	JŠ
MR Cas	51377.3956	0.0023	I	–	−0.0249	JŠ
MS Cas	51484.4826	0.0034	I	–	0.0373	JŠ
	51518.4949	0.0096	I	–	0.0402	MZ; normal. min.
V345 Cas	51484.4329	0.0045	I	–	−0.0218	JŠ
	51535.4022	0.0026	I	–	−0.0206	MZ
V364 Cas	51433.5553	0.0030	I	–	−0.0223	JŠ
V851 Cas	51375.4178	0.0025	I	–	0.0267	JŠ
IM Cep	51331.3974	0.0020	I	–	−0.0858	JŠ
V358 Cep	51237.4391	0.0045	I	–	0.0248	MZ
CC Com	51274.4135	0.0017	II	–	−0.0106	JŠ
	51270.3329	0.0019	I	–	−0.0085	JŠ
	51272.5396	0.0017	I	–	−0.0087	MZ; normal. min.
DD Com	51284.3823	0.0011	I	–	−0.0209	JŠ
	51288.3587	0.0017	I	–	−0.0826	MZ; normal. min.
	51288.4904	0.0028	I	–	0.0491	MZ; normal. min.
DG Com	51288.4061	0.0023	I	–	−0.0406	MZ
EQ Com	51277.4220	0.0037	I	–	0.0162	JŠ
	51272.3499	0.0073	I	–	0.0102	MZ
GM Cyg	51277.5663	0.0019	I	–	−0.2645	JŠ
KV Cyg	51331.5191	0.0023	I	–	0.0404	JŠ
PW Cyg	51449.3761	0.0044	I	–	−0.0378	JŠ
QS Cyg	51399.4764	0.0036	I	–	−0.0136	MZ
QU Cyg	51435.4689	0.0022	I	–	−0.0760	MZ
	51399.3901	0.0026	I	–	−0.0761	MZ; normal. min.
	51399.5637	0.0027	I	–	0.0975	MZ; normal. min.
QX Cyg	51467.2123	0.0134	I	–	0.2656	MZ; normal. min.

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
V454 Cyg	51375.4166	0.0030	I	–	−0.0052	JŠ
	51433.3395	0.0035	I	–	−0.0047	JŠ
V484 Cyg	51378.5600	0.0036	I	–	0.0970	MZ,DH; normal. min.
	51404.4403	0.0037	I	–	0.1008	MZ
V502 Cyg	51399.5386	0.0022	I	–	0.0981	MZ
V681 Cyg	51399.5050	0.0028	I	–	0.0558	MZ
V693 Cyg	51379.4837	0.0059	I	–	−0.0139	MZ; normal. min.
V704 Cyg	51399.4937	0.0043	I	–	0.0309	MZ
V706 Cyg	51404.4559	0.0025	I	–	−0.0289	MZ
V711 Cyg	51465.4125	0.0019	I	–	−0.2470	MZ; normal. min.
V842 Cyg	51284.5151	0.0028	I	–	0.0240	JŠ
V865 Cyg	51435.3704	0.0019	II	–	0.0372	MZ; normal. min.
	51404.5050	0.0030	I	–	0.0398	MZ
	51433.3625	0.0030	I	–	0.0385	JŠ
	51449.4328	0.0033	I	–	0.0355	JŠ
V880 Cyg	51394.5641	0.0010	I	–	−0.0027	MZ
V906 Cyg	51399.3648	0.0071	I	–	0.0503	MZ; normal. min.
V907 Cyg	51435.3534	0.0032	I	–	0.0048	MZ
V931 Cyg	51378.4536	0.0018	I	–	−0.0022	MZ
V961 Cyg	51379.3653	0.0020	I	–	−0.0665	JŠ
V963 Cyg	51277.5487	0.0024	I	–	0.0005	JŠ
V970 Cyg	51404.4241	0.0037	I	–	−0.0055	MZ
	51465.3735	0.0024	I	–	−0.0072	MZ
V1004 Cyg	51379.3813	0.0031	I	–	−0.0774	JŠ,MZ; normal. min.
V1010 Cyg	51399.4802	0.0023	I	–	−0.0130	MZ
V1047 Cyg	51435.4094	0.0025	I	–	0.0311	MZ
V1048 Cyg	51375.4184	0.0035	I	–	0.0190	JŠ
V1130 Cyg	51392.4815	0.0013	I	–	−0.0297	JŠ
V1321 Cyg	51302.4987	0.0027	I	–	0.0579	JŠ
V1414 Cyg	51375.4989	0.0010	I	–	0.0404	JŠ
	51449.3226	0.0030	I	–	0.0358	JŠ
V1580 Cyg	51435.4085	0.0057	I	–	−0.0772	MZ
V1787 Cyg	51363.4315	0.0030	I	–	−0.0101	JŠ
V1908 Cyg	51375.4322	0.0036	I	–	−0.1829	JŠ
	51449.3558	0.0023	I	–	−0.1855	JŠ
V2239 Cyg	51435.3488	0.0013	I	–	0.0059	MZ
	51427.4094	0.0013	I	–	0.0031	JŠ
	51449.3886	0.0045	I	–	0.0039	JŠ
V2240 Cyg	51435.4750	0.0019	II	–	−0.0006	MZ
	51375.4523	0.0016	I	–	−0.0005	JŠ
	51392.4321	0.0020	I	–	0.0032	JŠ
	51427.3936	0.0016	II	–	0.0019	JŠ
	51433.4575	0.0025	II	–	0.0029	JŠ
	51449.4213	0.0029	I	–	0.0010	JŠ
BI Del	51363.4456	0.0042	I	–	−0.1414	JŠ
BO Del	51435.3854	0.0034	I	–	−0.0981	MZ
Z Dra	51272.4081	0.0028	I	–	−0.1210	MZ
TW Dra	51195.5401	0.0047	I	–	0.0249	MZ
XY Dra	51270.5752	0.0034	I	–	−0.0029	JŠ
	51379.3916	0.0022	I	–	−0.0026	JŠ
TZ Gem	51193.5236	0.0033	I	–	0.0310	MZ; normal. min.
AV Gem	51195.5077	0.0017	I	–	−0.0286	MZ
EG Gem	51195.4970	0.0016	I	–	0.2298	MZ
GM Gem	51193.4292	0.0065	I	–	−0.0132	MZ
HR Gem	51195.4837	0.0022	I	–	0.0173	MZ
	51241.4481	0.0017	I	–	0.0163	JŠ

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
KQ Gem	51237.3462	0.0021	I	–	−0.0603	MZ
	51277.3339	0.0018	I	–	−0.0558	JŠ
	51484.5917	0.0014	I	–	−0.0582	JŠ
KV Gem	51193.3688	0.0016	II	–	−0.0072	MZ
	51193.5493	0.0029	I	–	−0.0060	MZ; normal. min.
	51195.5199	0.0017	II	–	−0.0073	MZ
	51237.4690	0.0019	I	–	−0.0049	MZ; normal. min.
	51481.4279	0.0013	I	–	−0.0182	JŠ
	51484.4897	0.0044	II	–	−0.0038	JŠ
	51518.5512	0.0060	II	–	−0.0016	MZ; normal. min.
AM Her	51277.5182	0.0017	I	–	0.0030	JŠ
DH Her	51288.4941	0.0019	I	–	−0.0034	MZ
ES Her	51404.4611	0.0041	I	–	−0.0148	MZ
	51401.3354	0.0082	I	–	−0.0124	MZ; normal. min.
V502 Her	51274.5718	0.0024	I	–	0.0054	JŠ
	51270.5095	0.0038	I	–	0.0052	JŠ
	51288.6060	0.0014	I	–	0.0071	MZ; normal. min.
V643 Her	51404.4730	0.0056	I	–	−0.2662	MZ; normal. min.
V719 Her	51274.5120	0.0042	II	–	−0.0128	JŠ
	51270.5027	0.0028	II	–	0.0084	JŠ
DE Hya	51543.5111	0.0090	I	–	0.0414	MZ
CG Lac	51535.2584	0.0048	I	–	−0.1286	MZ
EX Lac	51363.4276	0.0035	I	–	0.1970	JŠ
GH Lac	51465.4782	0.0082	I	–	−0.1071	MZ
	51374.4120	0.0121	I	–	−0.0910	MZ; normal. min.
	51535.2520	0.0021	I	–	−0.1098	MZ
HW Lac	51435.3783	0.0009	I	–	−0.0387	MZ
HX Lac	51435.4143	0.0022	I	–	−0.0749	MZ
IP Lac	51274.5529	0.0034	II	–	0.0633	JŠ
	51433.4529	0.0025	I	–	0.0633	JŠ
KO Lac	51535.3059	0.0137	I	–	0.1225	MZ; normal. min.
LU Lac	51435.4035	0.0023	I	–	0.0324	MZ; normal. min.
	51435.5538	0.0019	II	–	0.0333	MZ; normal. min.
NR Lac	51435.3780	0.0029	I	–	0.0521	MZ
	51401.5132	0.0028	I	–	0.0563	MZ
	51467.4369	0.0036	I	–	0.0564	MZ
NS Lac	51535.3083	0.0079	I	–	−0.1876	MZ
V344 Lac	51142.4126	0.0027	I	–	−0.0433	MZ; normal. min.
	51467.5729	0.0026	I	V	−0.0397	MZ; normal. min.
	51467.3782	0.0017	II	V	−0.0383	MZ
Y Leo	51302.4123	0.0011	I	–	0.0124	JŠ
UU Leo	51241.3776	0.0024	I	–	0.1030	JŠ
VZ Leo	51241.4290	0.0025	I	–	−0.0454	JŠ
BL Leo	51288.3507	0.0022	II	–	−0.0119	MZ; normal. min.
	51272.5578	0.0027	II	–	−0.0167	MZ
	51272.4173	0.0023	I	–	−0.0162	MZ; normal. min.
BW Leo	51288.4661	0.0021	II	–	−0.0421	MZ
CE Leo	51270.4522	0.0020	I	–	−0.0057	JŠ
AH Lyn*	51237.4575	0.0048	I	–	−0.0094	MZ
	51241.5290	0.0040	I	–	−0.0035	JŠ
AH Lyr	51277.4896	0.0026	I	–	−0.1098	JŠ
DU Lyr	51331.5120	0.0020	I	–	0.1510	JŠ
DZ Lyr	51404.4542	0.0038	I	–	−0.0021	MZ
FH Lyr	51377.3899	0.0026	I	–	0.0145	JŠ
GZ Lyr	51375.4921	0.0050	I	–	0.0016	JŠ

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
IP Lyr	51379.5022	0.0025	I	–	−0.0018	JŠ
PY Lyr	51274.5194	0.0030	I	–	−0.0564	JŠ
	51331.4199	0.0015	II	–	−0.0553	JŠ
V361 Lyr	51288.3772	0.0041	I	–	−0.0394	MZ; normal. min.
	51404.4854	0.0037	I	–	−0.0372	MZ
	51435.2925	0.0323	II	–	−0.0369	MZ; normal. min.
	51435.4469	0.0025	I	–	−0.0373	MZ
V401 Lyr	51399.5437	0.0061	I	–	0.3138	MZ; normal. min.
V404 Lyr	51449.3947	0.0040	I	–	−0.0707	JŠ
TV Mon	51481.5142	0.0030	I	–	0.0071	JŠ
VX Mon	51237.4747	0.0055	I	–	−0.6930	MZ; normal. min.
AY Mon	51484.5586	0.0033	I	–	0.0199	JŠ
V532 Mon	51535.5646	0.0092	I	–	0.0662	MZ; normal. min.
EG Ori	51195.5685	0.0072	I	–	−0.0750	MZ
	51543.3551	0.0090	I	–	−0.0750	MZ; normal. min.
FH Ori	51193.4578	0.0024	I	–	−0.2685	MZ
GU Ori	51241.3810	0.0020	I	–	−0.0148	JŠ
	51481.4266	0.0009	I	–	−0.0166	JŠ
	51543.5568	0.0023	I	–	−0.0162	MZ; normal. min.
QV Ori	51543.4714	0.0041	I	–	0.0340	MZ; normal. min.
V645 Ori	51484.4323	0.0019	I	–	0.0344	JŠ
V648 Ori	51484.5131	0.0026	I	–	0.4495	JŠ
BY Peg	51377.3751	0.0014	I	–	−0.0495	JŠ
CC Peg	51465.5215	0.0082	I	–	0.0794	MZ; normal. min.
CE Peg	51465.3019	0.0030	I	–	−0.2291	MZ; normal. min.
	51535.2888	0.0063	I	–	−0.2224	MZ
EY Peg	51484.3518	0.0042	I	–	−0.2716	JŠ
WY Per	51535.3943	0.0048	I	–	−0.0353	MZ; normal. min.
DK Per	51433.5082	0.0025	I	–	0.0156	JŠ
II Per	51535.4383	0.0112	II	–	−0.0377	MZ
QU Per	51484.5821	0.0040	I	–	−0.0043	JŠ
V366 Per	51433.4168	0.0025	I	–	0.0708	JŠ
DK Sge	51377.4571	0.0017	I	–	0.1178	JŠ
EI Sge	51378.5884	0.0019	II	–	−0.0572	MZ; normal. min.
	51378.3961	0.0014	I	–	−0.0554	MZ; normal. min.
	51394.5121	0.0075	II	–	−0.0517	MZ
FL Sge	51394.4155	0.0090	I	–	0.0701	MZ
BI Ser	51274.4858	0.0021	I	–	0.1724	JŠ
CX Ser	51270.4526	0.0030	II	–	−0.0714	JŠ
AQ Tau	51241.2997	0.0015	I	–	−0.0657	JŠ
	51484.4754	0.0035	I	–	−0.0708	JŠ
EN Tau	51481.5843	0.0024	I	–	−0.0040	JŠ
ES Tau	51518.5578	0.0074	I	–	0.0091	MZ; normal. min.
V407 Tau	51481.5101	0.0005	I	–	0.3301	JŠ
UX UMa	51195.6834	0.0017	I	–	0.0035	MZ; normal. min.
VV UMa	51241.4599	0.0020	I	–	−0.0543	JŠ
AW Vir	51288.4012	0.0032	I	–	0.0102	MZ
AX Vir	51288.4350	0.0037	I	–	0.0040	MZ
DY Vir	51237.5370	0.0110	I	–	−0.1071	MZ; normal. min.
AW Vul	51331.4316	0.0025	I	–	0.0001	JŠ
AX Vul	51302.4795	0.0018	I	–	−0.0214	JŠ
BG Vul	51394.4404	0.0028	I	–	0.0108	MZ
	51404.5246	0.0025	I	–	0.0137	MZ

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
BI Vul	51394.4209	0.0018	I	–	0.0823	MZ
	51378.4289	0.0016	I	–	−0.0451	MZ
	51378.5566	0.0054	I	–	0.0826	MZ; normal. min.
	51435.3414	0.0027	I	–	−0.0435	MZ; normal. min.
BK Vul	51404.6176	0.0031	I	–	0.0898	MZ; normal. min.
BM Vul	51374.5363	0.0174	I	–	0.0872	MZ; normal. min.
BT Vul	51270.5658	0.0016	I	–	−0.0002	JŠ
FF Vul	51331.4968	0.0016	II	–	0.0065	JŠ
	51392.4562	0.0046	II	–	0.0028	JŠ
	51433.3953	0.0035	II	–	0.0032	JŠ
FM Vul	51377.4279	0.0028	I	–	0.0191	JŠ
FR Vul	51374.4444	0.0029	I	V	−0.0036	MZ
GI Vul	51363.4919	0.0014	I	–	−0.0145	JŠ
GV Vul	51435.4750	0.0018	I	–	0.0612	MZ
NO Vul	51375.3597	0.0020	I	–	−0.0552	JŠ

Explanation of the remarks in the table:

DH = Hanžl, D., JŠ = Šafář, J., MZ = Zejda, M.; normal min. = times of minima were obtained from superposition of two or more parts of light curve from different nights.

Remarks:

The obtained timings of minima are used especially to improve the light elements of stars given in catalogue BRKA of observing programme of eclipsing binaries of BRNO-Variable Star Section. The catalogue contains more than 1500 eclipsing binaries and it is updated at least one times per year. It is available on `http://var.astro.cz/brno` .

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UBVRI PHOTOMETRY OF SN 2002ap IN M74

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The Supernova SN 2002ap in M74 was discovered by Y. Hirose (reported by Nakano et al., 2002) on Jan. 29, 2002. Low resolution spectra by Kinugasa et al. (2002), Meikle et al. (2002), and Filippenko and Chornock (2002) showed that overall spectral features resemble that of the Ic SN – type, called also "hypernovae" (see Filippenko, 1997). Detailed studies revealed that progenitor mass of SN 2002ap, as well as explosion energy and ejected mass are smaller than the respective values for a typical "hypernovae" (Mazzali et al., 2002). The radial velocity of SN 2002ap matches well the red - shift of M74 (Smartt and Meikle, 2002), which confirms the association of SN 2002ap with the M74 host galaxy.

In this note we report $UBVRI$ photometry of SN 2002ap, obtained at Rozhen National Astronomical Observatory, Bulgaria, and using all our 3 optical telescopes: 2-m Ritchey – Chretien telescope with Photometrics CCD camera (1024×1024), 60-cm Cassegrain with photon counting, UBV photometer, and the 50/70-cm Schmidt telescope with SBIG ST8 CCD. The observations were carried out during February and March, 2002. Standard reduction procedure was applied to the differential photometry of SN 2002ap with respect to the comparison star No 1 = GSC 1205 789 (see Gal–Yam et al., 2002), where the $UBVRI$ mags are from Henden (2002). We estimate that our errors are not larger than 0.06 mag.

The Rozhen observations are listed in Table 1.

For the light curves, we added other observations, as follows : 7U, 12B, 326V, 13R, 15I - data by Gal–Yam et al. (2002); 2I data by Mattila and Meikle (2002); 3R data by Hornoch (2002); 2U, 2B, 2V and 2R data by Yoshii et al. (2002); 5U, 5B, 5R data by Riffeser et al. (2002). We find good agreement of all data sets and the combined light curves of SN 2002ap are shown on Figure 1. From Figure 1, we estimate that maximum brightness in V occurred on Feb 8.7 UT. However, there is a shift of the maximum light in the different passbands, with a progressive delay of maximum at longer wavelengths. This has also been noticed by Gal–Yam et al. (2002). In Table 2, we show for respective passbands the JD and the magnitude at maximum, as well as the slopes of the light curves after maximum. Figure 2 shows the color curves. In Figure 2, reddening in all colours is apparent, which is caused by the delay of maximum and by the different slopes after the maximum in the different passbands. The total light amplitude of SN 2002ap remains unknown, as prediscovery images (Vreeswijk and Smartt, 2002) show no visible star at that position to the limiting magnitude. For the maximum light, with $V = 12\overset{m}{.}38$, $E(B-V) = 0\overset{m}{.}09$ (Takada – Hidaii et al., 2002, see in Mazzali et al., 2002), standard reddening law and distance to M74 of 8 Mpc (Sharina et al., 1996), we get for the SN 2002ap : Mv = -17.4.

Table 1: UBVRI Photometry of SN 2002ap from Rozhen NAO.

JD	*U*	*B*	*V*	*R*	*I*	Telescope
2452310.213	13.326	13.138	12.501	12.582	12.590	2-m RCC
2452311.280	13.309	13.082	12.442	12.447	12.442	2-m RCC
2452312.242	13.499	13.150	12.427	12.413	12.423	2-m RCC
2452313.256	13.608	13.152	12.380	12.327	12.327	2-m RCC
2452315.259	–	13.245	12.292	–	–	60-cm
2452315.214	–	13.341	12.376	12.273	11.979	Schmidt
2452319.249	–	13.717	12.591	12.326	12.214	Schmidt
2452340.221	–	–	14.149	13.702	13.138	2-m RCC
2452352.235	–	–	14.500	14.012	13.353	Schmidt

Table 2: SN 2002ap : JD, magnitudes at maximum and slopes after maximum.

	U	*B*	*V*	*R*	*I*
JD−2452000	309.2	310.8	314.2	314.9	317.5
Magnitude	13.23	13.19	12.38	12.24	12.18
Slope [mag/day]	0.12	0.08	0.07	0.06	0.04

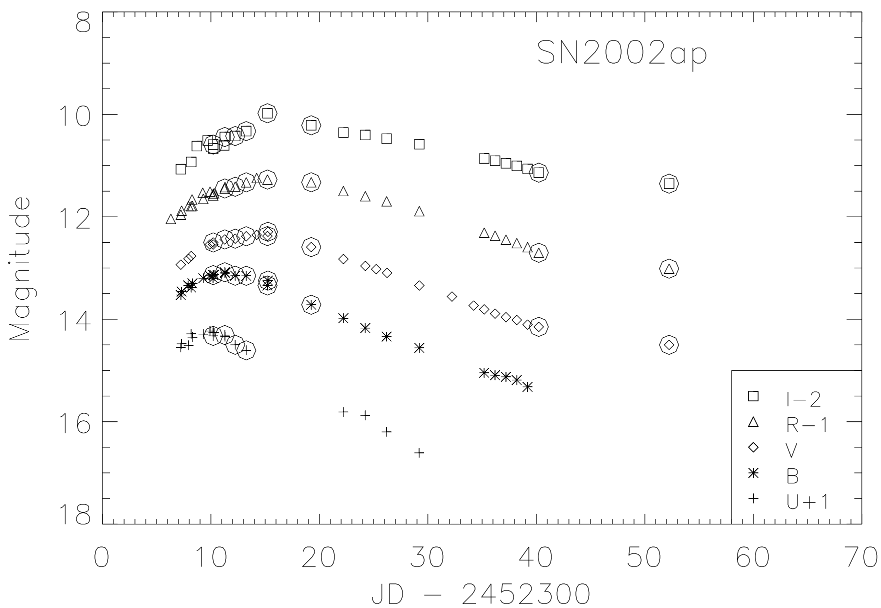

Figure 1. *UBVRI* light curves of SN 2002ap. Encircled symbols are observations from NAO Rozhen. Light curves in *U*, *R* and *I* are shifted in ordinate for better presentation.

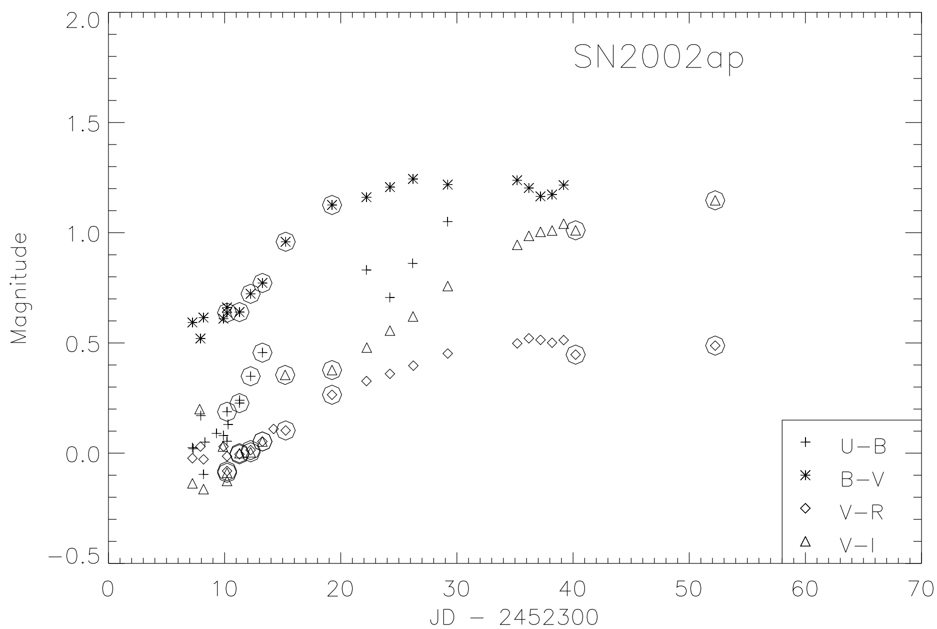

Figure 2. Colour curves of SN 2002ap. Encircled symbols are observations from NAO Rozhen.

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A NEW 7-DAY CLASSICAL CEPHEID IN CASSIOPEIA

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Name of the object:
Var 74 = GSC 4281.1972

Equatorial coordinates:	**Equinox:**
R.A.= $23^{h}44^{m}43\overset{s}{.}6$ **DEC.=** $+61^\circ16'58''$	J2000.0

Observatory and telescope:
40-cm astrograph in Crimea

Detector:	Photoplate

Filter(s):	None

Date(s) of the observation(s):
1948-1994

Comparison star(s):	USNO-A2.0	α (J2000)	δ (J2000)	B_{pg}
	1500.09991623	$23^{h}45^{m}01\overset{s}{.}0$	$+61^\circ18'34''$	$14\overset{m}{.}82$
	1500.09980530	$23^{h}44^{m}19\overset{s}{.}1$	$+61^\circ18'19''$	$15\overset{m}{.}38$
	1500.09984515	$23^{h}44^{m}34\overset{s}{.}6$	$+61^\circ19'23''$	$15\overset{m}{.}78$

Check star(s):	None

Transformed to a standard system:	B_{pg}
Standard stars (field) used:	B-band standard sequence in NGC 7654 (Hoag et al., 1961)

Availability of the data:
Upon request

Type of variability:	DCEP

Remarks:

The brightness of the newly discovered variable star was estimated by eye on 599 plates from Moscow archive, JD 2432853–49633. Periodic variability typical of a classical Cepheid was revealed. The light elements are the following:

$$\mathrm{JD}_{\mathrm{max}} = 2442486.26 + 7\overset{\mathrm{d}}{.}67786 \times E.$$

The variability range is $14\overset{\mathrm{m}}{.}95$–$15\overset{\mathrm{m}}{.}70$. Max − min = $0\overset{\mathrm{P}}{.}35$. The phased light curve (Fig. 1) shows a hump on descending branch, in agreement with the Hertzsprung progression for this value of period.

Acknowledgements:

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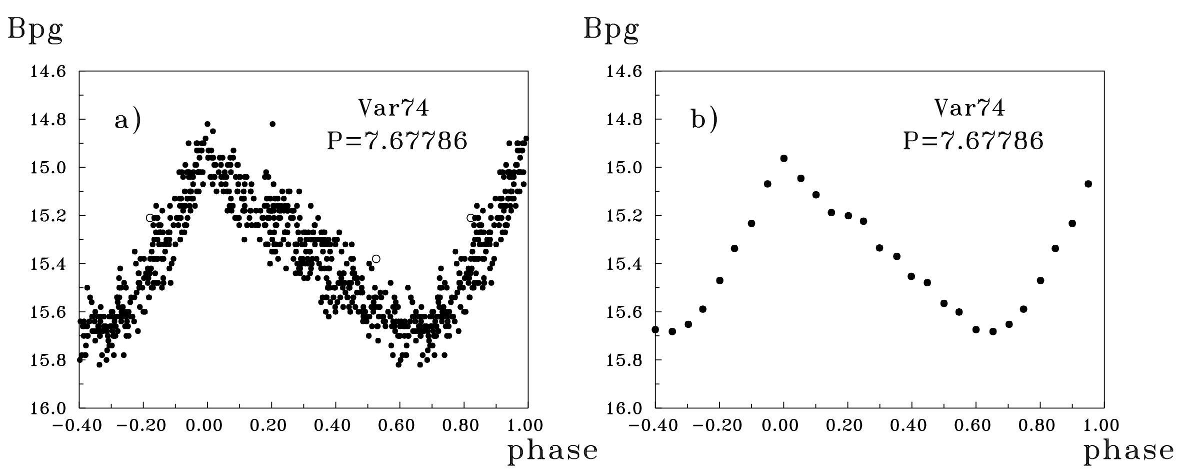

Figure 1. Phased light curve (a) and mean phased light curve (b). Uncertain estimates are shown as open circles.

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RECOVERY OF AS Psc AT MINIMUM LIGHT

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Kato & Uemura (2001) recently reviewed the outburst history and characteristics of this star and concluded that it is a likely dwarf nova, though its subtype remains indeterminate. At minimum it is below the sky survey limit (though a possible candidate is just visible on the POSS-II J image).

I obtained images in $UBVI(kc)$ on 2002 Jan 18 UT, using the MDM Observatory 2.4m Hiltner telescope on Kitt Peak, Arizona, and a SITe 2048^2 CCD. The image scale was $0\farcs275$ pixel^{-1}. Three exposures were obtained in each filter, totaling 720, 540, 360, and 360 s in $UBVI(kc)$ respectively. I measured instrumental magnitudes using the IRAF implementation of DAOPHOT.

Conditions were not photometric, but a few nights later T. Miller obtained shallower $UBVI(kc)$ images of the same field with the 1.3m McGraw-Hill telescope under photometric conditions. Several Landolt (1992) standard star fields were obtained the same night, and the calibration appears consistent to better than 0.03 mag in V. The 1.3m pictures provided local secondary photometric standards which are listed in Table 1, and these were used to calibrate the 2.4 m images. Astrometric solutions for all the images are from fits to numerous USNO A2.0 stars (Monet et al., 1996).

Fig. 1 shows the average 2.4m B-band image. The star marked at the center is at

$$\alpha_{\rm ICRS} = 1^{\rm h}28^{\rm m}08\fs37, \quad \delta_{\rm ICRS} = +31^\circ14'57\farcs3,$$

$\pm0\farcs3$ (estimated uncertainty). This is consistent with the outburst position (Duerbeck 1987). It has

$$(U-B) = -1\fm15, \quad (B-V) = +0\fm11, \quad V = 22\fm11, \quad \text{and } (V-I) = 0\fm07;$$

the total uncertainties (random plus systematic) should be < 0.1 mag, except for $U-B$, which is a little worse. (The colors could be affected by rapid variations between exposures, but we have no evidence of this).

Because of the close positional coincidence of this object with the outbursting object, and colors typical of a dwarf nova at minimum light, this is clearly the quiescent counterpart. Kato & Uemura (2001) report $B = 15\fm3$ at maximum, and we see it at $B = 22\fm2$. It could possibly get somewhat fainter, so we can conclude that $\Delta B \geq 6\fm9$. This is not unusual for dwarf novae, and supports Kato & Uemura's classification.

Table 1. AS Psc Field Star Photometry

α	δ	$U-B$	$B-V$	V	$V-I$
1:27:52.11	31:15:43.3	0.11(3)	0.68(2)	16.823(14)	0.78(2)
1:27:57.25	31:17:21.5	0.217(17)	0.727(15)	15.665(10)	0.825(13)
1:28:02.27	31:18:55.5	0.01(2)	0.594(16)	16.959(11)	0.731(16)
1:28:03.49	31:13:36.7	0.68(3)	0.916(15)	16.502(11)	1.024(16)
1:28:04.36	31:12:17.6	0.02(2)	0.566(18)	16.780(14)	0.69(2)
1:28:05.16	31:14:09.9	0.28(3)	0.710(17)	17.594(10)	0.810(15)
1:28:06.58	31:17:50.4	0.07(4)	0.582(17)	17.961(10)	0.733(17)
1:28:07.43	31:15:28.0	−0.088(19)	0.579(12)	17.367(8)	0.769(11)
1:28:08.88	31:12:35.8	0.04(3)	0.594(14)	17.378(9)	0.742(18)
1:28:09.71	31:13:26.4	0.17(5)	0.66(2)	18.142(12)	0.81(2)
1:28:10.20	31:13:48.2	0.90(4)	0.950(11)	16.815(7)	1.044(11)
1:28:10.89	31:11:32.0	0.50(7)	0.87(4)	17.93(2)	0.89(3)
1:28:13.71	31:17:04.4	0.014(5)	0.613(4)	15.153(2)	0.738(4)
1:28:14.07	31:16:30.9	1.28(2)	1.368(5)	15.145(3)	1.645(4)
1:28:16.00	31:16:56.0	0.12(2)	0.688(10)	17.151(5)	0.820(10)
1:28:16.33	31:11:51.1	0.36(6)	0.82(3)	18.067(16)	0.90(2)
1:28:19.81	31:16:26.9	−0.076(5)	0.558(3)	15.130(2)	0.765(4)
1:28:23.74	31:17:13.7	1.27(8)	1.358(13)	16.876(5)	1.637(7)
1:28:26.66	31:12:24.9	0.638(10)	0.953(11)	14.459(8)	1.012(12)
1:28:27.30	31:17:45.0	−0.12(3)	0.443(15)	17.904(9)	0.709(13)
1:28:27.86	31:15:45.9	0.454(6)	0.807(5)	13.997(2)	0.845(4)
1:28:28.05	31:18:09.4	0.139(10)	0.640(6)	16.063(4)	0.719(7)

NOTES to Table 1: Coordinates are ICRS, from a fit to 38 USNO A2.0 stars in a 1.3m CCD image obtained 2002 January. They should be accurate to $\sim 0\overset{s}{.}3$, with somewhat better relative accuracy. The magnitude uncertainties given in parentheses are *formal* 1σ errors; the systematic uncertainties are expected to be ~ 0.03 mag except for $U-B$, which is worse. Two sets of $UBVI$ images were used. Only those stars measured successfully in all filters on both sets of images with consistent magnitudes are tabulated.

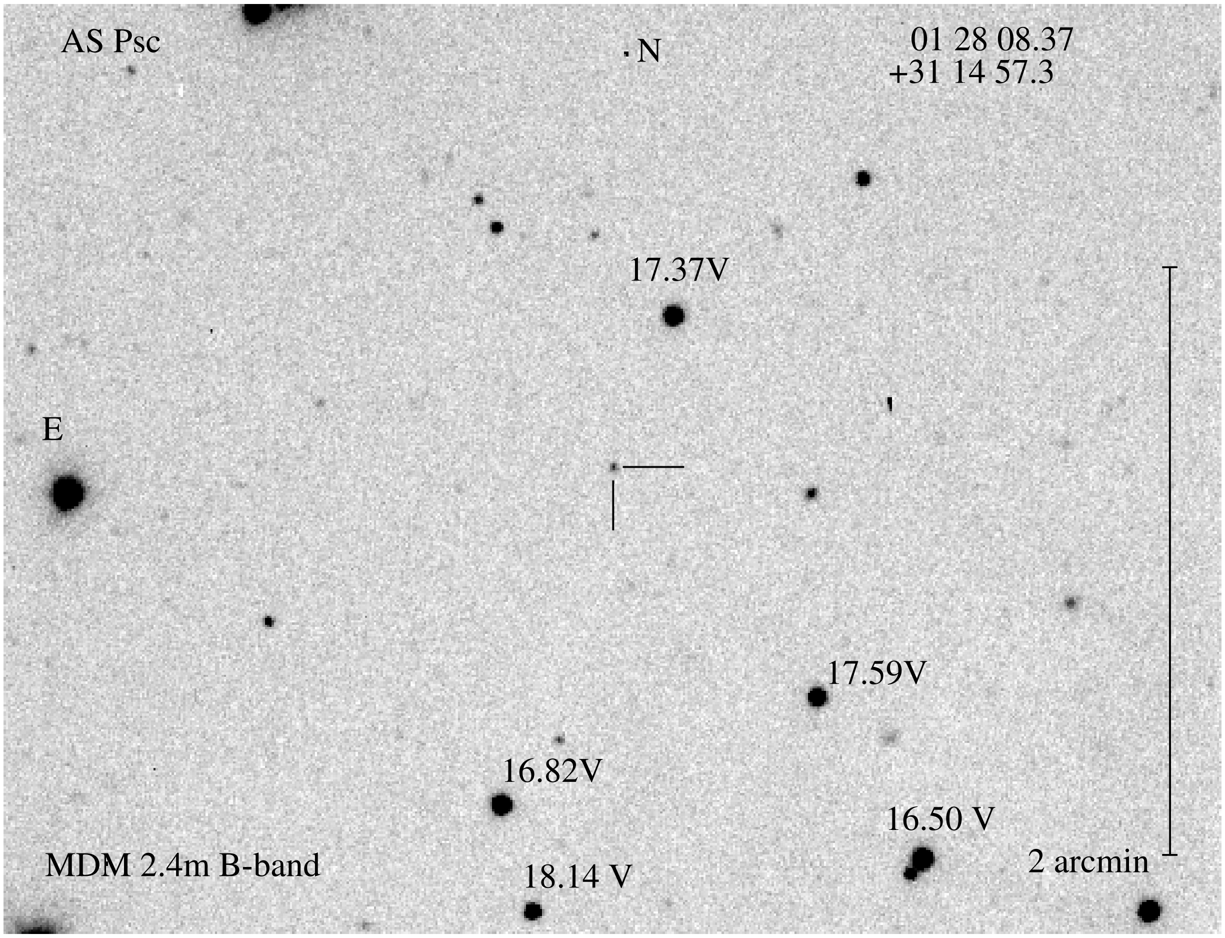

Figure 1. Finding chart, from the average of three 2.4m B-band images. North is at the top, east is at the left, and a 2-arcmin scale bar is at right. Field stars are labeled with their V magnitudes. The B image is shown to maximize the visibility of the counterpart.

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MULTIPERIODICITY IN THE δ SCUTI VARIABLE GSC 2899-00521

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The variability of the star GSC 2899-00521 ($\alpha_{2000} = 05^{\rm h}48^{\rm m}45\overset{\rm s}{.}1$; $\delta_{2000} = +40°15'16''$) was suspected as a result of the STARE (STellar Astrophysics & Research on Exoplanets) project in Auriga. It received the preliminary designation aur0 5472 (STARE Home Page). An amplitude of 0.04 mag and a period of 0.15132 days were suggested. This makes the star a candidate Delta Scuti variable.

The star was observed at Beersel Hills Observatory during 9 nights between October 2001 and February 2002. A total of 1159 data points were obtained in V during 53.7 hours of photometry. During two nights, BVR photometry was acquired (114 data points in each colour). The instrument used was a 0.40-m telescope, equipped with a ST7E CCD camera and a filterset following Bessel's specifications. The exposure times varied between 50 and 90 seconds. In addition 27 data points were obtained in V during 2.7 hours of observations with the 1.0-m telescope and the HOLICAM CCD camera of the Hoher List Observatory (University of Bonn, Germany). The images were standard dark-framed and flatfielded and were reduced with the aperture photometry procedure of the Mira AP software package†.

The brightness of the variable was measured with respect to GSC 2899-01786, while the stars GSC 2899-01257 and GSC 2899-02149 were used as check stars. The average instrumental magnitudes with respect to the comparison star are given in Table 1.

Table 1. Average instrumental magnitudes compared to GSC 2899-01786

Star	GSC 2899-	ΔB	ΔV	ΔR
var	00521	−0.54	−0.59	−0.62
check1	01257	−0.37	−0.53	−0.61
check2	02149	0.26	0.32	0.35

Standard deviations of the observations are of the order of 0.02 mag or smaller. The nightly standard deviation of the differences in V magnitude between the comparison and the first check star measured at BHO, ranged between $0\overset{\rm m}{.}006$ and $0\overset{\rm m}{.}016$, and between $0\overset{\rm m}{.}009$ and $0\overset{\rm m}{.}024$ for the second check star. In B and R, standard deviations were $0\overset{\rm m}{.}012$

†The Mira AP software is produced by Axiom Research Inc.

and $0.^{m}015$ respectively, for both stars. At Hoher List this standard deviation amounted to $0.^{m}005$ for both check stars in V.

Our light curve clearly shows the multiperiodic behaviour typical of Delta Scuti stars. Fig. 1 shows B, V and R differential magnitudes for a particular night. The Fourier analysis program Period98 (Sperl, 1998) was used to detect the frequencies in the light curve. Fig. 2 shows the amplitude spectrum from the BHO V data. Two frequencies can easily be identified: at $6.610 \pm 0.005 c/d$ (corresponding to the period given by STARE) and $13.356 \pm 0.005 c/d$.

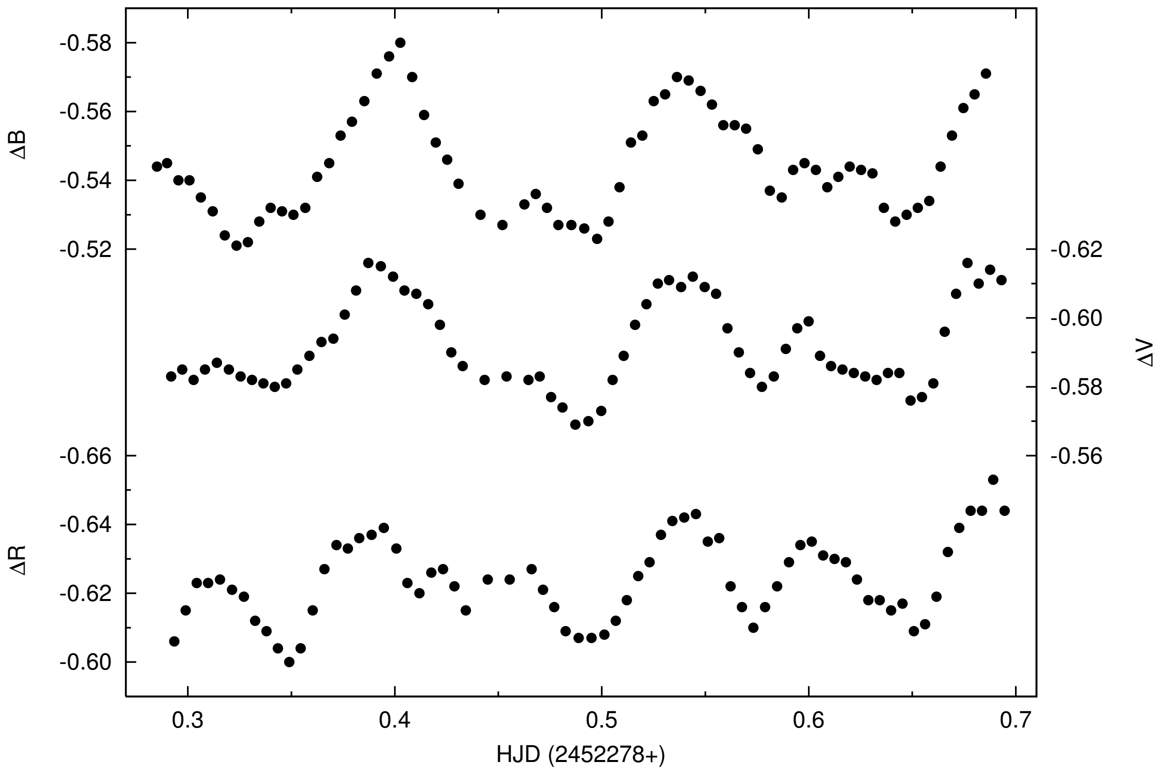

Figure 1. B (upper curve), V (middle curve) and R (lower curve) plots of the magnitude of GSC 2899-00521 compared to GSC 2899-01786, on the night of January 3rd, 2002.

After prewhitening for these two frequencies, a third frequency appears, with a signal-to-noise ratio of 5 (see Fig. 3). This frequency is located at $6.745 \pm 0.005 c/d$, corresponding to the difference between the second and the first frequency. Due to the specific spectral window for the observations, there are strong aliases of this frequency which differ by 0.03 c/d and 1 c/d. So there is still a possibility that the third frequency is not really a linear combination of the two other frequencies detected.

The same method was used to analyse the data from the STARE project (STARE Home Page). These data were obtained in 1997/8. The same three frequencies appear, with a much smaller amplitude (the wavelength of these observations resembles R). There

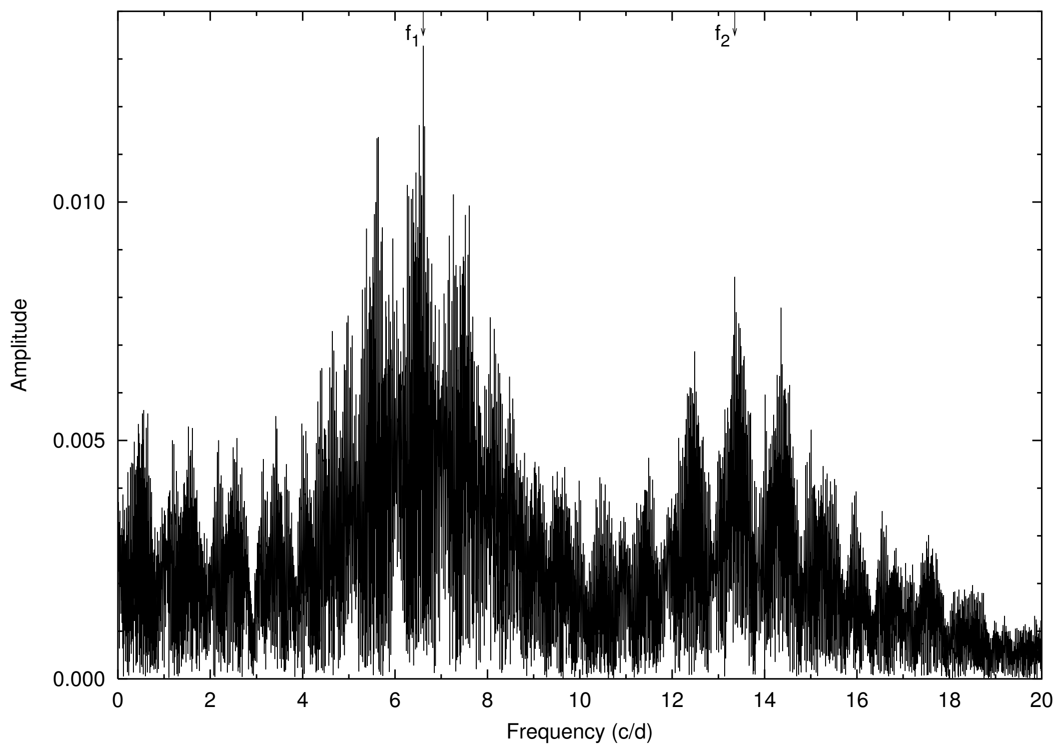

Figure 2. Amplitude spectrum of the V data.

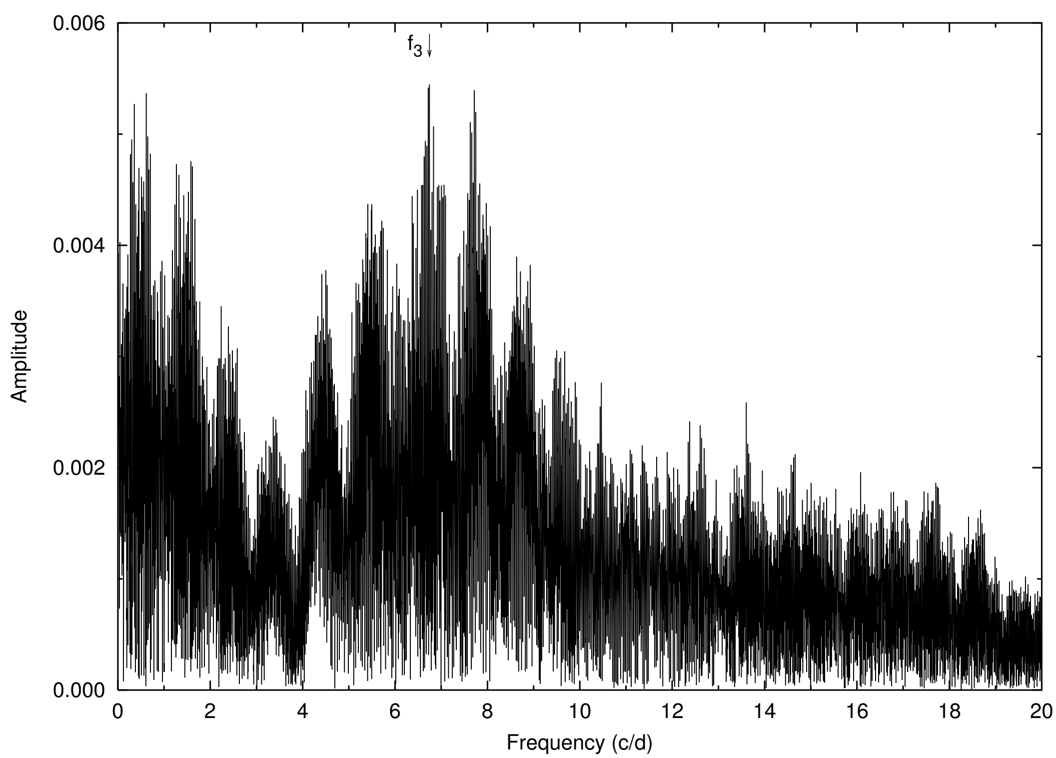

Figure 3. Amplitude spectrum after prewhitening for the two main frequencies.

is a 0.03 c/d alias of the third frequency as well, namely $6.711 \pm 0.010 c/d$, which in this case has a higher amplitude. The S/N ratio is only 3 for this frequency, but since it is a combination of the other two frequencies, it is significant (Breger et.al., 1993).

The semi-amplitudes of the two main frequencies on the two nights with multi-colour photometry, obtained from a fit with these two frequencies only, are listed in Table 2 (in mmag). They are compared to the semi-amplitudes of our complete data set (in V) and the STARE data set, with all three frequencies fitted. While the amplitudes of the first two frequencies have a ratio 2 to 1 in B and V, they are equal in R. This may aid in the identification of the pulsation modes of this star.

Table 2. Semi-amplitudes of GSC 2899-00521 (in mmag)

Frequency	[c/d]	V (all data)	B	V	R	STARE
f_1	6.610	15	18	14	10	8
f_2	13.356	8	9	7	10	7
$f_2 - f_1$	6.745	6	–	–	–	4

Acknowledgement: P. Lampens and P. Van Cauteren are grateful to Prof. W. Seggewiss for the telescope time and the hospitality at the Hoher List-Universitätssternwarte, University of Bonn, Germany. P. Van Cauteren is grateful to the Royal Observatory of Belgium for putting at his disposal material acquired by project G.0265.97 of the Fund for Scientific Research (FWO) - Flanders (Belgium).

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OUTBURST PHOTOMETRY OF EY Cyg

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EY Cyg is a well-known dwarf nova with a very long cycle length. In spite of its relatively bright magnitude ($V\ \sim 11\overset{\rm m}{.}4$ at maximum, $V\ \sim 15\overset{\rm m}{.}5$ at minimum), no time-resolved CCD or photoelectric photometry has been yet published. We observed EY Cyg on two outburst occasions in 1992 and 2001. Between these outbursts, only one additional outburst (1997 January) is known, which was poorly observed because of the unfavorable seasonal condition.

The 1992 observations were done on three nights between April 5 and 11, using a CCD camera (Thomson TH 7882, 576 × 384 pixels, on-chip 3 × 3 binding adopted) attached to the Cassegrain focus of the 60 cm reflector (focal length=4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 20–40 s depending on the transparency. The 2001 observations were done on 12 nights between November 15 and December 4, using an unfiltered ST-7E CCD camera attached to a Meade 25-cm Schmidt-Cassegrain telescope, located in Kyoto University. The exposure time was 30 s. The frames were first corrected for standard de-biasing (Ouda data) or dark subtraction (Kyoto data) and flat-fielding, and were then processed by a microcomputer-based aperture photometry package (Ouda data) or Java™-based aperture photometry package developed by one of the authors (TK). We used two comparison stars GSC 2673.525 (Tycho-2 magnitude V=$10\overset{\rm m}{.}89 \pm 0\overset{\rm m}{.}06$, $B-V$=$+0\overset{\rm m}{.}46 \pm 0\overset{\rm m}{.}08$) and GSC 2673.2950 (Tycho-2 magnitude V=$11\overset{\rm m}{.}47 \pm 0\overset{\rm m}{.}10$, $B-V$=$+0\overset{\rm m}{.}31 \pm 0\overset{\rm m}{.}14$), whose constancy during the run was confirmed by inter-comparison. The magnitudes of EY Cyg were determined relative to the sum of these two stars (Ouda data) or relative to GSC 2673.525 (Kyoto data). Barycentric corrections to observed times were applied before the following analysis. Table 1 lists the log of observations, together with nightly averaged magnitudes.

Figure 1 shows the light curves of the 1992 and 2001 outbursts drawn from nightly averaged magnitudes by this study. Both sets of observations covered the decline from outbursts. The object showed on both occasions a linear fading at a rate of 0.30 mag d^{-1} (1992) or 0.28 mag d^{-1} (2001) for the first seven nights. This rate of decline can be thus considered to be a typical value for EY Cyg.

Figure 2 shows the nightly light curves (please note the vertical axis is shifted reflecting the mean brightness of the object) for the 1992 outburst. These light curves show slow modulation with a time-scale of ∼0.1–0.2 d. On the first night (April 5), a slow decline and a shallow minimum near the end of the run was observed. On April 7, a

Table 1. Nightly averaged magnitudes of EY Cyg

Start[a]	End[a]	Mean mag[b]	Error[c]	N[d]	Site
48718.257	48718.337	1.481	0.002	192	Ouda
48720.209	48720.329	1.764	0.002	332	Ouda
48724.207	48724.327	2.967	0.002	258	Ouda
52229.061	52229.073	0.496	0.012	24	Kyoto
52230.049	52230.066	0.673	0.006	42	Kyoto
52233.020	52233.028	1.485	0.005	22	Kyoto
52234.062	52234.082	1.856	0.009	49	Kyoto
52235.032	52235.053	2.170	0.006	50	Kyoto
52236.019	52236.044	2.439	0.013	61	Kyoto
52237.023	52237.044	2.506	0.031	43	Kyoto
52239.018	52239.041	2.674	0.055	46	Kyoto
52240.010	52240.020	3.064	0.054	21	Kyoto
52241.007	52241.021	2.934	0.024	35	Kyoto
52245.007	52245.020	2.908	0.058	27	Kyoto
52247.989	52248.007	2.969	0.028	42	Kyoto

[a] BJD−2400000.
[b] Relative magnitude (see text).
[c] Standard error of nightly average.
[d] Number of frames.

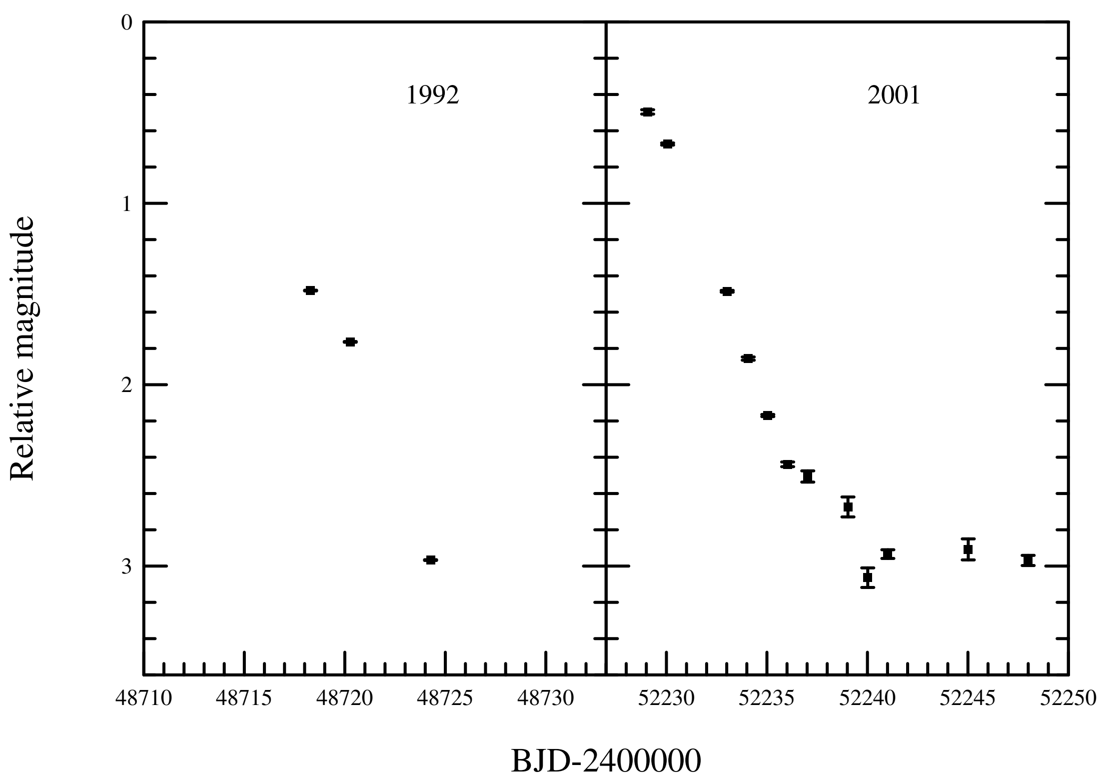

Figure 1. Light curve of EY Cyg on two outbursts in 1992 and 2001. The zero point for the 1992 observation corresponds to $V = 10\overset{\mathrm{m}}{.}39 \pm 0\overset{\mathrm{m}}{.}08$.

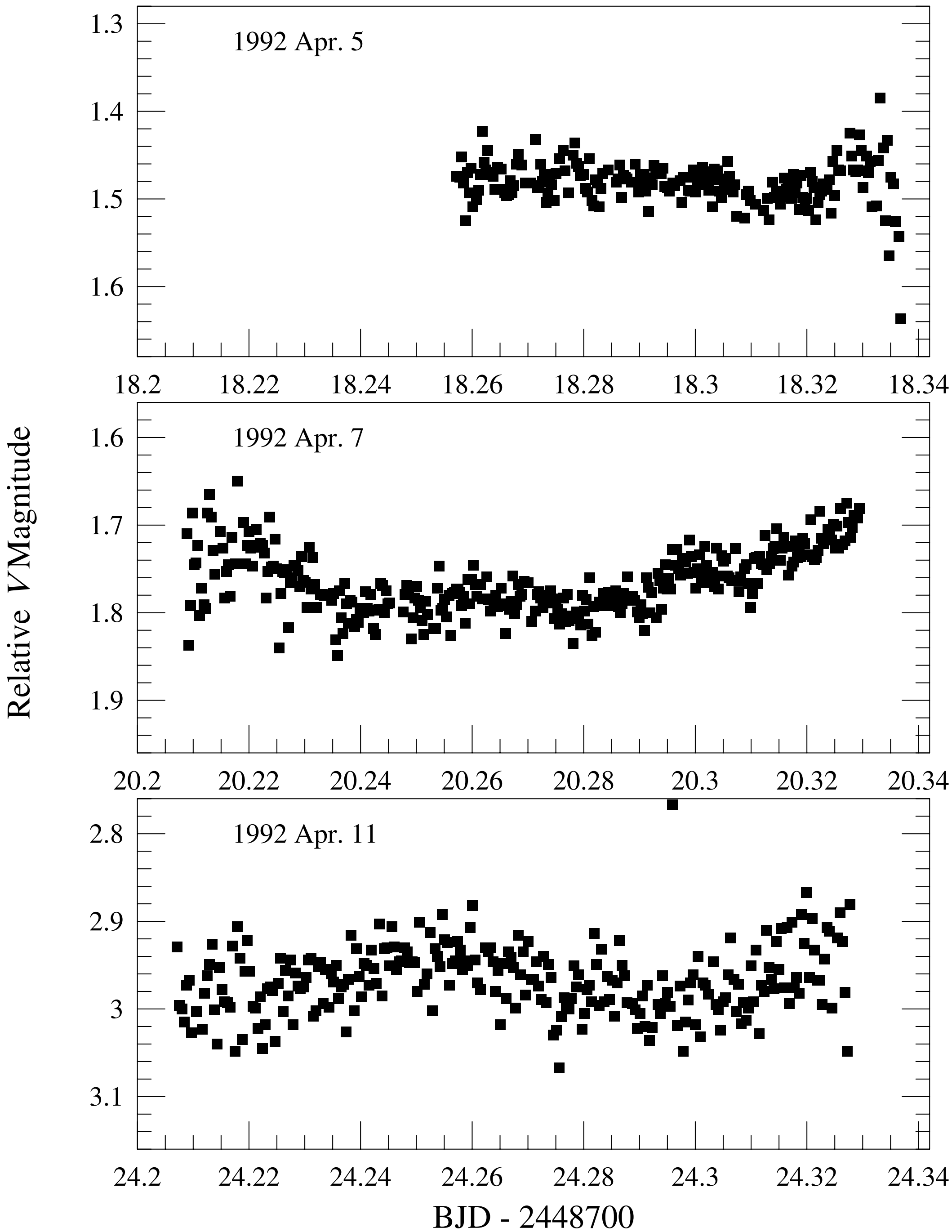

Figure 2. Light curve of the 1992 April outburst of EY Cyg. The zero points are the same as in Figure 1.

fading and brightening clearly defined a rather flat-bottomed minimum. On April 11, the variation looks more sinusoidal. This observation makes the unique time-resolved photometry during outburst. To our best knowledge, these modulations look to more reflect slow quasi-periodic variations rather than the stable orbital period. A period search between $0^{\rm d}.1$ and $0^{\rm d}.3$, using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978), has yielded the strongest signals near $0^{\rm d}.192$ and $0^{\rm d}.212$, but the values should be treated with caution because neither observing run was long enough to adequately assess the possibility of a longer periodicity. Because of the shortness of each run, we were not able to test the presence of this periodicity in the 2001 observation.

The orbital period of EY Cyg has not been yet unambiguously determined. Hacke and Andronov (1988) gave a photometric period of $0^{\rm d}.18228$ from their photographic observations. Sarna et al. (1995) further obtained CCD photometry and gave a period of $0^{\rm d}.2165$. Smith et al. (1997) obtained optical spectra and identified the secondary as a K5–M0 star. The lack of radial velocity variations observed by Smith et al. (1997) suggests a low inclination system. Since a K5–M0 companion usually suggests a longer orbital period (cf. Ritter and Kolb 1998), these photometric periodicities need to be further examined.

The decline rate observed in this study is 0.28–0.30 mag d^{-1}, which is close to that of DX And (Kato and Nogami 2001), a dwarf nova with an orbital period of $0^{\rm d}.4405$. From the similarity of outburst cycle lengths and outburst durations between EY Cyg and DX And, and from the application of Bailey's relation (Bailey 1975; Szkody and Mattei 1984; Warner 1995) to the decline rates, we propose a longer orbital period close to that of DX And.

Regarding short-period oscillations, we detected low-amplitude (<0.05 mag), fluctuations with time scales of 10–60 min (small wiggles in Figure 2), but we could not find any firm periodicity.

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CCD LIGHT CURVES OF ROTSE1 VARIABLES, XIV: GSC 1996:437 Com, GSC 2004:784 CVn, GSC 2001:300 Boo AND GSC 3026:1046 CVn

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Observatory and telescope:
Private observatory Schüsselacher, Wald, 0.15-m Starfire refractor

Detector:	SBIG ST-7 CCD camera

Method of data reduction:
Standard CCD-frame reduction using AIP4WIN software

Method of minimum determination:
Kwee – van Woerden algorithm

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp./check star(s)
GSC 1996:437				
ROTSE1 J131424.16+271131.6	EW	13 14 24.2	+27 11 32	GSC 1996:1314 / GSC 1996:1114
GSC 2004:784				
ROTSE1 J133638.49+281139.0	EW	13 36 38.5	+28 11 39	GSC 2004:424 / GSC 2004:1406
GSC 2001:300				
ROTSE1 J133659.37+265247.6	EW	13 36 59.4	+26 52 48	GSC 2001:193 / GSC 2001:285
GSC 3026:1046				
ROTSE1 J133726.05+373458.4	EW	13 37 26.0	+37 34 58	GSC 3026:979 / GSC 3026:922

Ephemeris:

Star name	E 2400000+	P [day]	Source
GSC 1996:437	52308.4688	0.412749	present paper
GSC 2004:784	52308.4873	0.2720494	”
GSC 2001:300	52308.4567	0.367879	”
GSC 3026:1046	52296.6908	0.349271	”

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
GSC1996:437 (Com)	51274.7388	15	s	none		ROTSE1
	51306.7291	8	p	none		ROTSE1
	52285.5617	9	s	none		Blättler, 2002
	52287.6248	10	s	none		Blättler, 2002
	52296.4972	11	p	none		Blättler, 2002
	52296.7039	34	s	none		Blättler, 2002
	52308.4679	7	p	none		Blättler, 2002
	52308.6766	11	s	none		Blättler, 2002
	52344.3776	10	p	none		Blättler, 2002
	52344.5872	7	s	none		Blättler, 2002
GSC2004:784 (CVn)	51281.6391	7	s	none		ROTSE1
	51310.8800	9	p	none		ROTSE1
	52285.4971	52	s	none		Blättler, 2002
	52285.6350	8	s	none		Blättler, 2002
	52287.5393	14	p	none		Blättler, 2002
	52296.5184	11	p	none		Blättler, 2002
	52296.6545	13	s	none		Blättler, 2002
	52308.4858	10	p	none		Blättler, 2002
	52308.6253	9	s	none		Blättler, 2002
	52344.3989	12	p	none		Blättler, 2002
	52344.5340	4	s	none		Blättler, 2002
	52347.3888	17	p	none		Blättler, 2002
GSC2001:300 (Boo)	51288.8770	8	s	none		ROTSE1
	51304.8864	13	p	none		ROTSE1
	52285.6431	12	p	none		Blättler, 2002
	52287.4875	19	p	none		Blättler, 2002
	52296.4993	16	s	none		Blättler, 2002
	52296.6830	8	p	none		Blättler, 2002
	52308.4565	21	p	none		Blättler, 2002
	52308.6451	9	s	none		Blättler, 2002
	52344.3277	15	s	none		Blättler, 2002
	52344.5103	9	p	none		Blättler, 2002
	52347.4509	33	p	none		Blättler, 2002
GSC3026:1046 (CVn)	51259.7031	6	p	none		ROTSE1
	51310.8766	18	s	none		ROTSE1
	52285.5102	12	p	none		Blättler, 2002
	52285.6886	4	s	none		Blättler, 2002
	52287.6107	6	p	none		Blättler, 2002
	52296.5182	11	s	none		Blättler, 2002
	52296.6901	8	p	none		Blättler, 2002
	52308.5659	5	p	none		Blättler, 2002
	52308.7351	21	s	none		Blättler, 2002
	52344.3681	7	s	none		Blättler, 2002
	52344.5409	6	p	none		Blättler, 2002
	52347.3352	3	p	none		Blättler, 2002

Explanation of the remarks in the table:
ROTSE1: Observations of Akerlof et al. (2000).

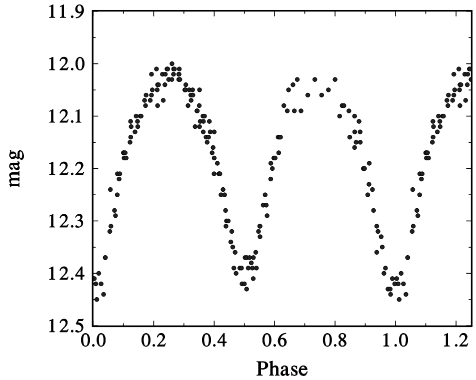

Figure 1. CCD light curve (without filter) of GSC 1996:437

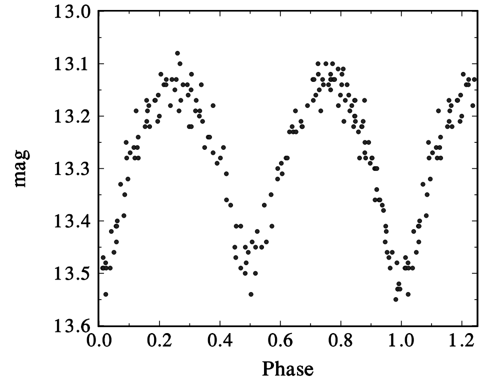

Figure 2. CCD light curve (without filter) of GSC 2004:784

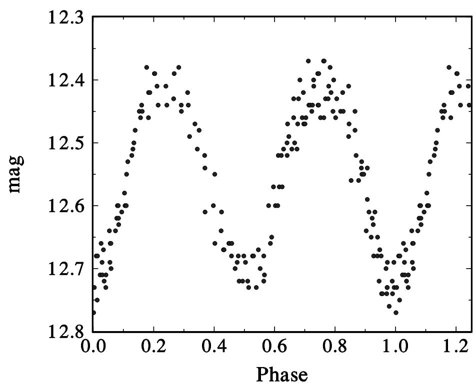

Figure 3. CCD light curve (without filter) of GSC 2001:300

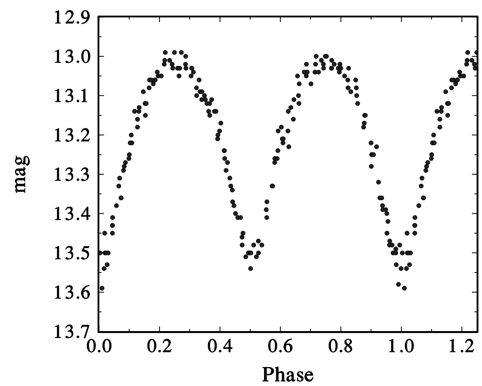

Figure 4. CCD light curve (without filter) of GSC 3026:1046

Remarks:

As a byproduct of the ROTSE1 CCD survey, a large number of new variables have been discovered (Akerlof et al., 2000). In a series of papers, we report unfiltered CCD observations for some of the close binary systems (type EW) in the list of Akerlof et al. (2000). This installment contains information on four variables in the constellations Com, Boo and CVn. The four stars were observed with our CCD equipment during 6 nights between JD 2452285 and JD 2452347. A total of 184 CCD frames were measured of GSC 1996:437, 179 frames of GSC 2004:784, 183 frames of GSC 2001:300 and 190 frames for GSC 3026:1046. Figures 1 through 4 show our observations folded with the elements given in the table of Ephemeris. These elements of variation are deduced from a linear fit to the normal minima from the ROTSE1 data and the timings of minimum derived from our data given in the table of Times of minima.

Availability of the data:
Upon request from diethelm@astro.unibas.ch

Acknowledgements:
This research made use of the SIMBAD data base, operated at CDS, Strasbourg, France

References:

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GSC 1609.00690, A NEW CLASSICAL CEPHEID

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Name of the object:
GSC 1609.00690

Equatorial coordinates:	**Equinox:**
R.A.= $19^h31^m12^s.0$ **DEC.=** $+19°01'19''$	J2000.0

Observatory and telescope:
40-cm astrograph in Crimea

Detector:	Photoplate

Filter(s):	None

Date(s) of the observation(s):
1960-1993

Comparison star(s):

GSC or USNO-A2.0	α (J2000)	δ (J2000)	B_{pg}
1609.00518	$19^h31^m14^s.3$	$+19°03'35''$	$14^m.78$
1609.00944	$19^h31^m23^s.0$	$+18°59'50''$	$15^m.18$
1050.13998661	$19^h31^m15^s.0$	$+18°59'40''$	$16^m.09$
1050.14001553	$19^h31^m20^s.0$	$+18°59'37''$	$16^m.54$

Check star(s):	None

Transformed to a standard system:	B_{pg}
Standard stars (field) used:	B-band standard sequence in NGC 6802 (Hoag et al., 1961)

Availability of the data:
Upon request

Type of variability:	DCEP

Remarks:

The new Cepheid was independently discovered by one of us (S.A.); the log of the Sternberg Institute blink comparator shows that, in the early 1980s, the star had been noticed by E. Kolevatykh (unpublished). We estimated the star by eye on 288 plates from Moscow archive, JD 2437136–49104. It turned out to be a classical Cepheid. Its light elements are:

$$\mathrm{JD}_{\mathrm{max}} = 2442599.47 + 6\overset{\mathrm{d}}{.}3236 \times E.$$

The variability range is $15\overset{\mathrm{m}}{.}1$–$16\overset{\mathrm{m}}{.}4$. Max − min = $0\overset{\mathrm{P}}{.}3$. The phased light curve is presented in Figure 1. The new variable is close to a known Cepheid, V354 Sge (Metzger and Schechter, 1998), at $\alpha = 19^{\mathrm{h}}31^{\mathrm{m}}15\overset{\mathrm{s}}{.}5$, $\delta = +19^\circ 00' 42''$(J2000). The latter Cepheid is, however, much fainter and has a different period, $P = 4\overset{\mathrm{d}}{.}1643$. The two Cepheids are not the same object beyond doubt.

Acknowledgements:

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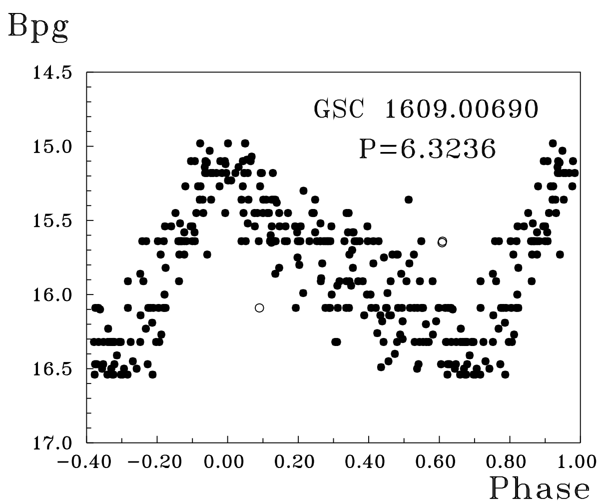

Figure 1. The phased light curve of the new Cepheid. Uncertain estimates are shown as open circles.

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Hoag, A.A., Johnson, H.L., Iriarte, B., Mitchell, R.I., Hallam, K.L., Sharpless, S., 1961, *Publ. of the US Naval Obs.*, **Vol. XVII**, Part VII, Washington

Metzger, M.R., Schechter, P.L., 1998, *Astron. J.*, **116**, 469

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THE REDDENED W UMa SYSTEM: GSC 1851-0320

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While engaged in a search for rotation rates of asteroids, Koff discovered light variations in the background star GSC 1851-0320. He used his 0.20-m SCT+unfiltered ST-6 CCD. Alerted by Koff, Kaiser used his 0.35-m SCT+ST-9E CCD+V filter to determine times of minimum light, the period and the light curve shape. Kuebler also started observations using a Celestron 14 and a Finger Lakes Instrumentation IMG512 camera. Henden used the USNO 1.0m telescope, a SITe 1024×1024 thinned, backside illuminated CCD and standard Johnson-Cousins filters. He found standardized BVR_CI_C magnitudes for the field using Landolt (1992) standard stars. The University of Victoria observations were made with our automated 0.5m telescope, Star I CCD, Johnson-Cousins filters and reduced in a fashion similar to that described in Robb and Greimel (1999). The field of stars observed is shown in Figure 1.

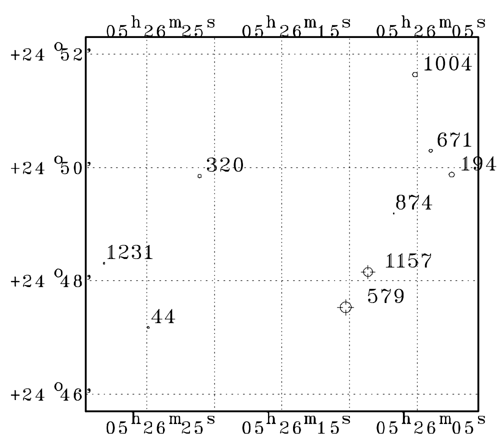

Figure 1. Finder chart labeled with the GSC identification numbers from region 1851.

Table 1: Stars observed in the field of GSC 1851-0320

Star GSC Id	R.A. J2000	Dec. J2000	GSC Mag.	ΔC Mag.	Std Dev Between	Std Dev Within
0320	$05^h26^m21\overset{s}{.}125$	$24°49'51\overset{''}{.}78$	13.8	2.625	0.009	0.055
0579	$05^h26^m10\overset{s}{.}294$	$24°47'32\overset{''}{.}57$	11.9	–	–	–
1157	$05^h26^m08\overset{s}{.}646$	$24°48'09\overset{''}{.}70$	12.4	1.654	0.007	0.008
0194	$05^h26^m02\overset{s}{.}426$	$24°49'52\overset{''}{.}60$	13.4	2.692	0.004	0.015
0671	$05^h26^m03\overset{s}{.}992$	$24°50'18\overset{''}{.}16$	13.9	2.383	0.004	0.012
1004	$05^h26^m05\overset{s}{.}150$	$24°51'38\overset{''}{.}85$	13.5	2.704	0.006	0.011
0044	$05^h26^m24\overset{s}{.}902$	$24°47'11\overset{''}{.}16$	14.3	3.374	0.012	0.014
1231	$05^h26^m28\overset{s}{.}204$	$24°48'19\overset{''}{.}49$	14.3	3.560	0.013	0.022

Table 2: Times of Minimum Light

HJD	Uncertainty	Observer	HJD	Uncertainty	Observer
2452177.9151	0.0004	RAK	2452267.0264	0.0010	RMR
2452183.9556	0.0007	RAK	2452267.8884	0.0003	RMR
2452184.9591	0.0007	RAK	2452268.0324	0.0005	RMR
2452199.9048	0.0004	RAK	2452268.7495	0.0005	RMR
2452207.9543	0.0008	RAK	2452268.8918	0.0005	RMR
2452225.7748	0.0003	DHK	2452296.6327	0.0016	RMR
2452250.7832	0.0008	RAK	2452317.6169	0.0010	KT
2452265.7334	0.0008	PK	2452317.7594	0.0006	KT
2452250.7850	0.0005	RMR	2452317.9040	0.0005	KT
2452266.7395	0.0004	RMR	2452320.7794	0.0006	KT
2452266.8810	0.0005	RMR	2452321.7829	0.0013	KT

Some observations were also made unfiltered (centered at $\sim$ 6500Å) designated C. The Julian Dates of observation (-2450000) are 2250R, 2266-2268C, 2296C, 2317C, 2320I, 2321V, 2322I, and 2334I. Table 1 lists the stars' identification numbers and magnitudes from the Hubble Space Telescope Guide Star Catalog (GSC) (Jenkner et al., 1990) and positions from the USNO-A 2.0 catalog (Monet et al., 1998).

Our differential ΔC magnitudes are calculated in the sense of the star minus GSC 1851-0579. Brightness variations during a night were measured by the standard deviation of the differential magnitudes and are listed for the most photometric night in the last column as "Std Dev Within". For each star the mean of the nightly means is shown as ΔC in Table 1. The standard deviation of the nightly means is a measure of the night to night variations and is called "Std Dev Between" in Table 1. The smallest "Std Dev Between" is 0.004 magnitudes and this excellent photometry shows that night to night variations in either of these stars must be less than a few millimagnitudes. We observed no significant variations in these stars in plots of the individual nights' data and a "Std Dev Within" one night of 0.008 sets an upper limit on variations of an hourly timescale.

The star GSC 1851-0320 had obvious variations during each night and most nights covered more than one cycle, causing the means for all nights to be similar. Times of minimum brightness of the star found using the method of Kwee and van Woerden (1956) are listed in Table 2. From these times of minimum light we find the ephemeris to be:

$$\text{HJD of Minimum Brightness} = 2452250\overset{\text{d}}{.}7845(6) + 0\overset{\text{d}}{.}287449(3) \times \text{E}.$$

where the uncertainties in the final digit are given in brackets and the RMS error of the fit is less than 0.0013 days. In Figure 2 the differential ΔC magnitudes phased at this period are plotted. The light curve is typical of W UMa systems.

All-sky photometry by Henden yeilds V=14$\overset{\text{m}}{.}$03 ± 0$\overset{\text{m}}{.}$06, $B-V$=1$\overset{\text{m}}{.}$39 ± 0$\overset{\text{m}}{.}$04, $V-R$=0$\overset{\text{m}}{.}$86 ± 0fmm01, and $R-I$=0$\overset{\text{m}}{.}$88 ± 0$\overset{\text{m}}{.}$01 (available on the IBVS website: 5271-t3.txt) and 2MASS measurements yield J=11$\overset{\text{m}}{.}$04, H=10$\overset{\text{m}}{.}$41, and K=10$\overset{\text{m}}{.}$24. These all indicate an approximately M0 spectral type for GSC 1851-0320, apparently making it the coolest W UMa known and deserving of further investigation. Therefore we observed the star with the DAO/HIA 1.8m telescope and obtained the spectrum shown in Figure 3.

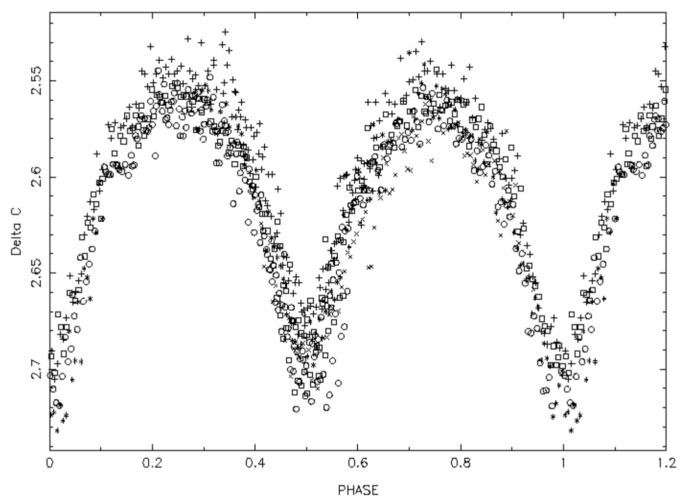

Figure 2. Unfiltered light curve of GSC 1851-0320 with different symbols for different nights.

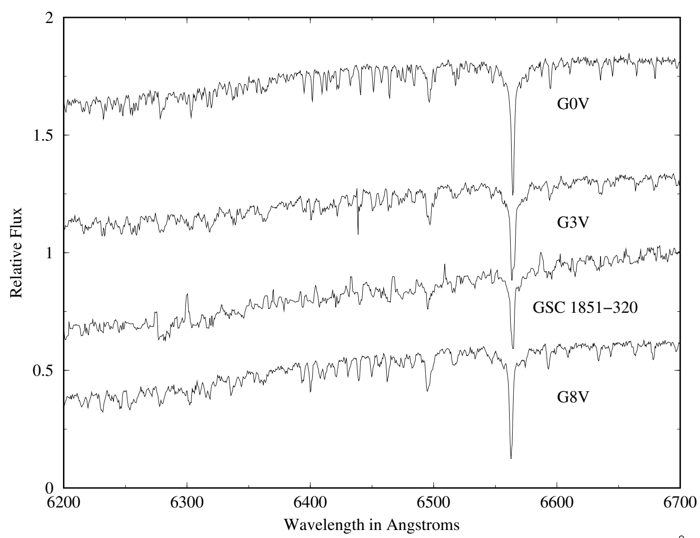

Figure 3. Spectrum of GSC 1851-0320 showing the Hα absorption line at 6563Å and FeI at 6497Å

Obviously the star's spectral type is not M but G. The reason for the discrepancy must be reddening, and in the Lick Observatory Sky Atlas (1967) we observe a dust cloud in the star's direction. Using the Java applet written by J. Köppen, found at `http://astro.u-strasbg.fr/~koppen/nebula/ExtCurv.html`, we find for an $E(B-V)$=0$\overset{\text{m}}{.}$73 ± 0.$\overset{\text{m}}{.}$10 a V extinction of 2$\overset{\text{m}}{.}$27 ± 0$\overset{\text{m}}{.}$30, and dereddened colors consistent with our G-type spectral classification. The relation given by Rucinski (2000) between absolute magnitude, the intrinsic color and period of a W UMa system yields $M_V = 4.64$. Combined with extinction, we find a distance of 260 ± 80pc to this system. The distance to the Taurus Star Forming Region is $\sim$ 140pc and therefore the dust cloud could be part of that region.

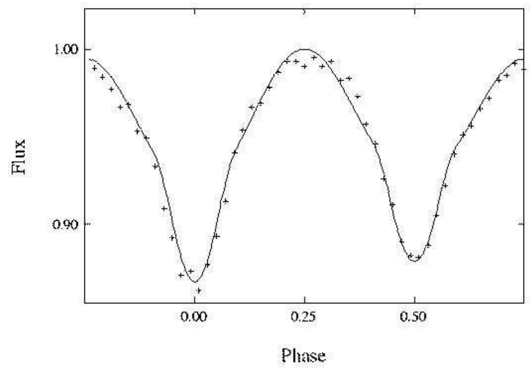

Figure 4. Model line and light curve points of GSC 1851-0320

While a definitive solution to the light curve is not possible with this data set, there exist physically plausible parameters, which fit the data fairly well. Our light curve model, synthesized using Binmaker2 (Bradstreet, 1993) is plotted with the binned data points in Figure 4. From the spectral class we assume a temperature for the hot star of 5600K and appropriate limb darkening (X=0.56), gravity darkening (g=0.32) and reflection (R=0.5) coefficients. The set of parameters we found were: radius of hot star of 0.37 ± 0.2, radius of cool star of 0.35 ± 0.2, temperature of the cool star of 5400K and an orbital inclination of $59° \pm 2°$. The uncertainty in the difference in temperature of the two stars is $\sim$ 100K. The small inclination makes the mass ratio indeterminate but a value of 0.94 is consistent with the temperature difference. We needed to include a spot on the cooler star to model the difference in maximum light.

This near contact model is consistent in temperature difference, mass ratio and ratio of the radii with a G4V orbited by a G6V star. While the color of GSC 1851-0320 is very red for a contact binary, we are convinced that this is a consequence of an intervening dust cloud and the system has the temperature and spectral class expected for its period.

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OBSERVATIONS OF FLARE STARS V577 Mon AND AD Leo

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In spite of a large efforts devoted to the study of flare stars, their nature is not yet completely solved (Haisch, Strong & Rodonó 1991, Hawley & Pettersen, 1991, Hawley & Fisher 1992, Vlahos et al. 1995). Therefore, each new observational data may help resolve this very important problem. We carried out observations of flare stars V577 Mon and AD Leo with the two-channel (U and B) fast photometer (Zalinian & Tovmassian 1989) installed at the 2.1 m telescope of the Guillermo Haro Observatory (GHO) in Cananea, México. Earlier we detected with this photometer very short spiky flares of a duration less than a second (Zalinian & Tovmassian 1987, Tovmassian & Zalinian 1988, Tovmassian et al. 1997a, Zalinian & Tovmassian 1997). The rising time of spiky flares is less than 0.1 sec. We showed that the spiky flares generally occur after normal flares, and are bluer than normal flares (Tovmassian et al. 1997b).

The log of observations is presented in Table 1. The night sky background was measured regularly after $\sim 15-20$ m of monitoring of the flare star. Therefore, the total time of observation of the star itself is less than the duration of the observing run. V577 Mon was observed with integration time 0.5 sec, and AD Leo with 0.2 sec.

The aim of our observations was to detect fast flares. Therefore, we measured the brightness of the observed stars in U and B in relation to their quiescent state. No regular variability of V577 Mon and AD Leo is known.

Table 1: The log of observations of V577 Mon and AD Leo in 2002.

Date	Start UT	End UT	Total duration h m
	V577 Mon		
20 Feb	02 44	05 50	0 45
21 Feb	03 30	05 32	1 50
22 Feb	03 55	05 30	1 45
	AD Leo		
21 Feb	07 11	10 08	2 20
22 Feb	06 46	10 15	2 35

Four flares were detected during 4^h20^m of monitoring of V577 Mon. During 4^h55^m of monitoring of AD Leo only one flare was detected. The light curves of the detected flares, and also the variations of $(U-B)$ magnitudes of the star during flare, are presented in Figures 1-5. In consecutive columns of Table 2 the date of the flare, the flare magnitudes ΔU and ΔB, the color of the star, $(U-B)$ at the peak of the flare, and the total duration of the flare are given. No spiky flares have been registered in the reported observations. Light curves of the detected flares, and also the variations of $U-B$ magnitudes of the star during flares, are presented in Figures 1-5. Each point on the $U-B$ graph is the average of 5 preceding and 5 subsequent measurements. The colour $U-B$ of the star during flare is deduced assuming that $U-B$ of V577 Mon in quiescent state is equal to $1^{m}.2$ (Shvartsman et al. 1988), that of the AD Leo is $1^{m}.06$ (Johnson & Morgan 1953).

Table 2: The parameters of flares of V577 Mon and AD Leo.

Date	ΔU	ΔB	$(U-B)$	Total duration
		V577 Mon		
20 Feb '02	$1^{m}.0$	$0^{m}.4$	$0^{m}.6$	$2^{m}05^{s}$
20 Feb '02	$1^{m}.5$	$0^{m}.5$	$0^{m}.2$	$7^{m}00^{s}$
21 Feb '02	$1^{m}.1$	$0^{m}.1$	$0^{m}.2$	$2^{m}33^{s}$
22 Feb '02	$0^{m}.4$	$0^{m}.0$	$0^{m}.8$	$6^{m}10^{s}$
		AD Leo		
21 Feb '02	$0^{m}.22$	$0^{m}.09$	$0^{m}.8$	$3^{m}50^{s}$

VPZ is grateful to the CONACYT Project 34564-E and to the INAOE for financial support and hospitality at the INAOE.

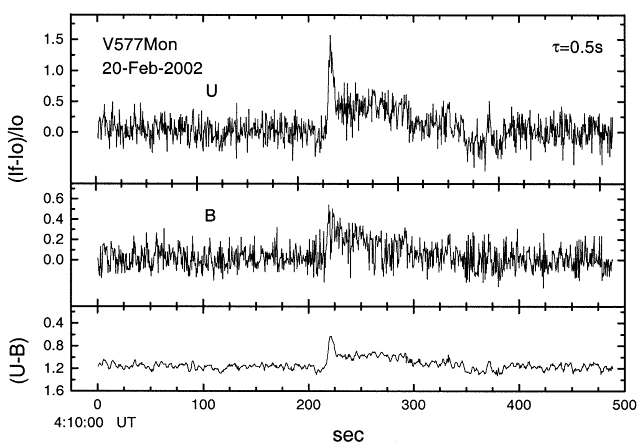

Figure 1. The flare of V577 Mon at $4^{h}10^{m}$ UT on 20 February 2002.

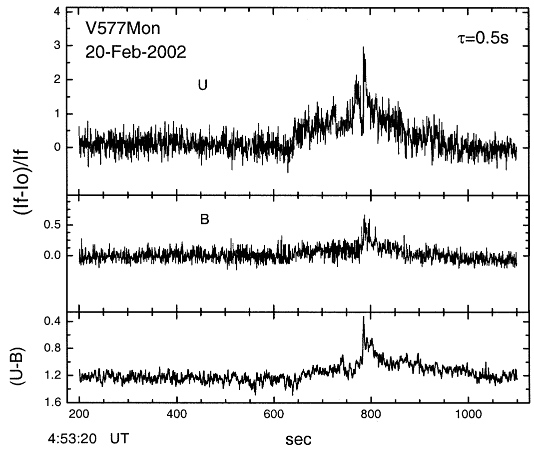

Figure 2. The flare of V577 Mon at 4^h50^m UT on 20 February 2002.

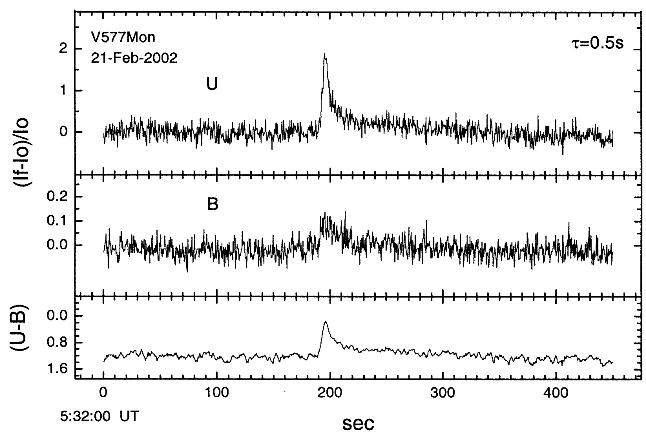

Figure 3. The flare of V577 Mon at 5^h32^m UT on 21 February 2002.

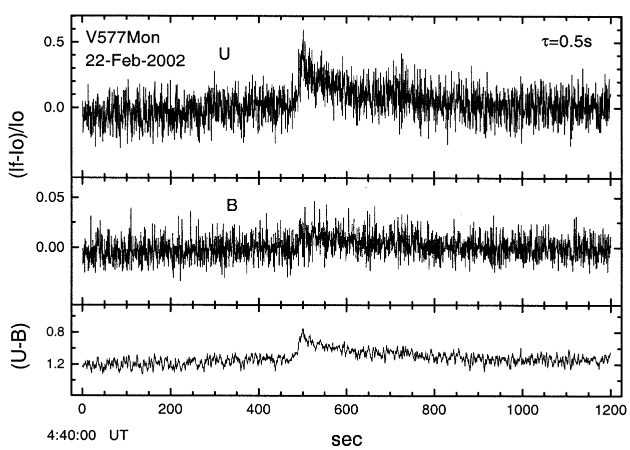

Figure 4. The flare of V577 Mon at 4^h40^m UT on 22 February 2002.

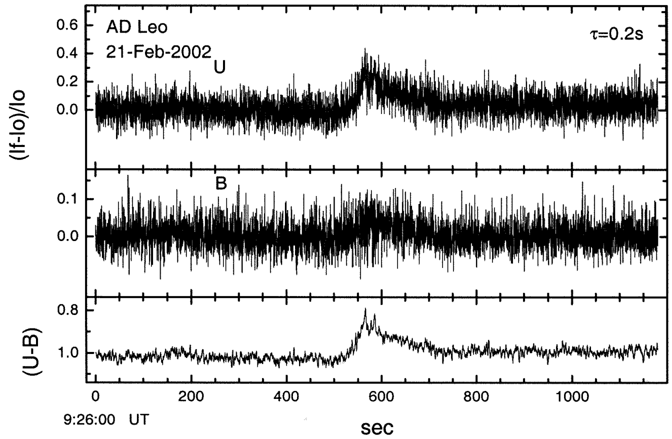

Figure 5. The flare of AD Leo at 9^h26^m UT on 21 February 2002.

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LIGHT MAXIMA OF THE RRab VARIABLE TU UMa IN EARLY 2002

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Following earlier work by Szeidl et al. (1986) and Saha and White (1990), Wade et al. (1999) published an analysis of timings of light maxima for TU UMa. They showed that a model combining a quadratic pulsation ephemeris with a light-time binary orbit of high eccentricity was most successful at describing the collected timing data. Periastron passage is predicted to occur in about 2011 (depending on what specific model is used), near which time there should be an excursion in the center-of-mass radial velocity of TU UMa. The elements of the ∼23 y binary orbit are still rather uncertain, as is the quadratic coefficient of the pulsation ephemeris. It is therefore useful to continue to collect epochs of light maximum, in order to test and refine the orbital/pulsational model.

We obtained differential light curves of TU UMa through Johnson B and V filters, using a SITe 512×512 CCD camera (6′ field of view) on the 0.41 m telescope of Braeside Observatory. Typically most of the rise to maximum, maximum light itself, and a significant portion of the decline were recorded, except for Cycle 47623 where only 1.2 h surrounding maximum was recorded, and Cycle 47702 where 1.9 h of the rise was recorded but not the maximum itself. Because of the distinctive and stable stillstand of the rising branch of the V light curve, we were nevertheless able to infer a (less certain) epoch of light maximum for Cycle 47702.

We determined five epochs of maximum light in V, using the same technique as described for Braeside observations in our previous paper (Wade et al. 1999). That is, we used a template light curve (HJD[max] = 2,450,527.7110, cycle 44413, 1997 March 20) and measured the time offset needed to bring the template and the newly observed light curve into registration.

Table 1 summarizes the new epochs of light maximum for TU UMa, giving the cycle count E on the same system as in Wade et al. (1999) and earlier papers cited therein. Column 3 gives the Julian year with 2000.00 = JD 2,451,545.0; column 4 gives $O - C$ in days relative to the linear test ephemeris used by Wade et al., HJD = 2425760.4364 + 0.5576581097E. A least-squares linear regression of epoch upon cycle number for the five epochs shows a residual scatter of 1.2 minutes in the measured epochs, similar to that of earlier photoelectrically recorded maxima for this star.

Table 1. Light Maxima of TU UMa in early 2002.

Cycle	HJD	Year	$O-C$ (days)
	2400000+		
47623	52317.803	2002.12	+0.014
47625	52318.9185	2002.12	+0.0146
47657	52336.7628	2002.17	+0.0139
47702	52361.860:	2002.24	+0.016:
47711	52366.8770	2002.25	+0.0145

The mean $O-C$ of 21.3 minutes can be compared with the expected $O-C$ of about 20 minutes at epoch 2000.2, if model "D" of Wade et al. (1999) is adopted as the correct description of the orbital and pulsational evolution. These are consistent within the measurement error, and there is not yet a need to update the model — collection of additional epochs of maximum light in the next several years will no doubt make refinement of the model worthwhile as periastron is approached.

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TEN NEW SEMI-REGULAR VARIABLES IN SAGITTARIUS

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We have conducted an extensive CCD monitoring program of the black hole binary (SAX J1819.3-2525 = V4641 Sgr) (Orosz et al. 2001). The goal of this study was to acquire accurate light curves in different bands to get better constraints on the physical parameters of the binary. The results will be presented elsewhere. As a byproduct of this campaign, we report here the discovery of ten new semi-regular variable stars in the field of V4641 Sgr.

Optical photometry was done with the YALO 1 m telescope at Cerro Tololo Inter-american Observatory (CTIO) (Bailyn et al. 1999), the CTIO 0.9 m telescope, the Dutch 0.9 m telescope at the European Southern Observatory (ESO), La Silla and the 1.0 m Jacobus Kapteyn Telescope (JKT) at La Palma (Table 1). The data were collected between July 2000 and October 2001. The IRAF data reduction package was used to apply the standard flat field and bias corrections to the images. For each telescope we made deep master images for each band by aligning the frames to common coordinate systems and coadding them. DAOPHOT (Stetson 1987, Stetson 1992) was used to do PSF fitting and to compute the instrumental magnitudes for each star. Stetson's program DAOMASTER was used to cross identify the stars in each data set and to construct time series photometry. Standard stars from the Landolt catalogue (Landolt 1992) observed with the JKT were used to place the magnitude scales on the standard system.

Table 1. Overview of the available datasets.

Observing run	Start date	End date	Frames	Filters	FOV
YALO	27-Mar-2001	15-Oct-2001	98	V and I	$10' \times 10'$
CTIO	21-Jul-2000	26-Jul-2000	255	U, B, V, R and I	$3'.3 \times 3'.3$
ESO	06-Jun-2001	28-Jun-2001	61	U, B, V, R and I	$3'.8 \times 3'.8$
La Palma	08-Sep-2000	14-Sep-2000	24	B, V, R and I	$8'.8' \times 2'.8$

Table 2. Photometric data.

Coordinates (J2000)	V [mag]	average $V-I$ [mag]	quasi period [days]	ID
18:19:16.8 −25:23:36.2	16.6 − 17.4	4.41	51	
18:19:22.0 −25:23:16.8	16.6 − 17.3	4.50	76	
18:19:10.6 −25:27:39.1	15.0 − 16.0	3.45	63	IRAS 18160-2529
18:19:02.5 −25:30:19.4	15.8 − 16.6	4.37	...	
18:19:03.0 −25:29:34.5	14.5 − 15.1	3.17	...	
18:19:03.7 −25:26:30.9	15.6 − 16.1	2.81	...	
18:19:06.5 −25:24:11.5	17.8 − 18.7	5.21	...	
18:19:28.0 −25:30:13.5	15.2 − 15.7	4.12	67	
18:19:02.2 −25:24:05.9	15.4 − 16.0	3.84	94	
18:19:40.8 −25:27:13.1	16.5 − 16.9	4.29	69	

We have light curves for about 15 000 stars, most of which appear only in the YALO images, since the YALO telescope has the largest field of view (2048 × 2048 pixels with a pixel size of $0\farcs3 \times 0\farcs3$, although the effective field of view of the aligned images was about $9' \times 9'$). We searched for variables using two simple techniques. First we computed the standard deviation σ of the light curves and made plots of σ vs. the mean magnitudes. Second, we computed Lomb-Scargle periodogram (Lomb 1976, Scargle 1982) for each star and sorted the stars according the highest L-S power. Once possible variables were flagged (either large σ or L-S power or both), the light curves were visually inspected and additional periodicity searches were done with the IRAF task 'pdm', an implementation of the phase dispersion technique of Stellingwerf (Stellingwerf 1978). Our sensitivity to large amplitude variables is high and we believe we have found $\gtrsim 95\%$ of the bright ($V \gtrsim 17^{\rm m}$) large amplitude ($\gtrsim 0.5$ mag) variables.

We found many variables. We report here a set of ten stars that seem to form a homogeneous group, see Figs. 1 and 2 for light curves and Figs. 3-12 for charts. Table 2 gives the positions, magnitude range and average $V-I$ colours of the ten stars. An astrometric solution for the YALO master image was found using stars from the USNOA2 catalogue and the estimated 1σ errors are $\lesssim 0\farcs5$ in each direction. The names of the stars are based on their coordinates in equinox 2000 and are given the prefix YALO. For example the first star in Table 2 at RA=18:19:16.8, DEC=−25:23:36.2 has the name YALO J181916.8-252336. Only one star has a plausible identification in SIMBAD: YALO J181910.6-252739 is probably IRAS 18160-2529.

One of the characteristics of all ten stars is that they are relatively red: average $V-I$ colours are between $2\fm8$ and $5\fm2$. The extinction in the direction of V4641 Sgr is relatively low ($E(B-V) = 0.25$, Orosz et al. 2001), so the red colours are not due to interstellar dust. The stars show slow and quasi-periodic variations with time scales between about 51 and 94 days and amplitudes in V of ∼1 magnitude. The red colours, the relatively large amplitude and the slow variability are characteristic of cool Asymptotic Giant Branch (AGB) stars (Sterken and Jaschek 1996, Kerschbaum et al. 2001).

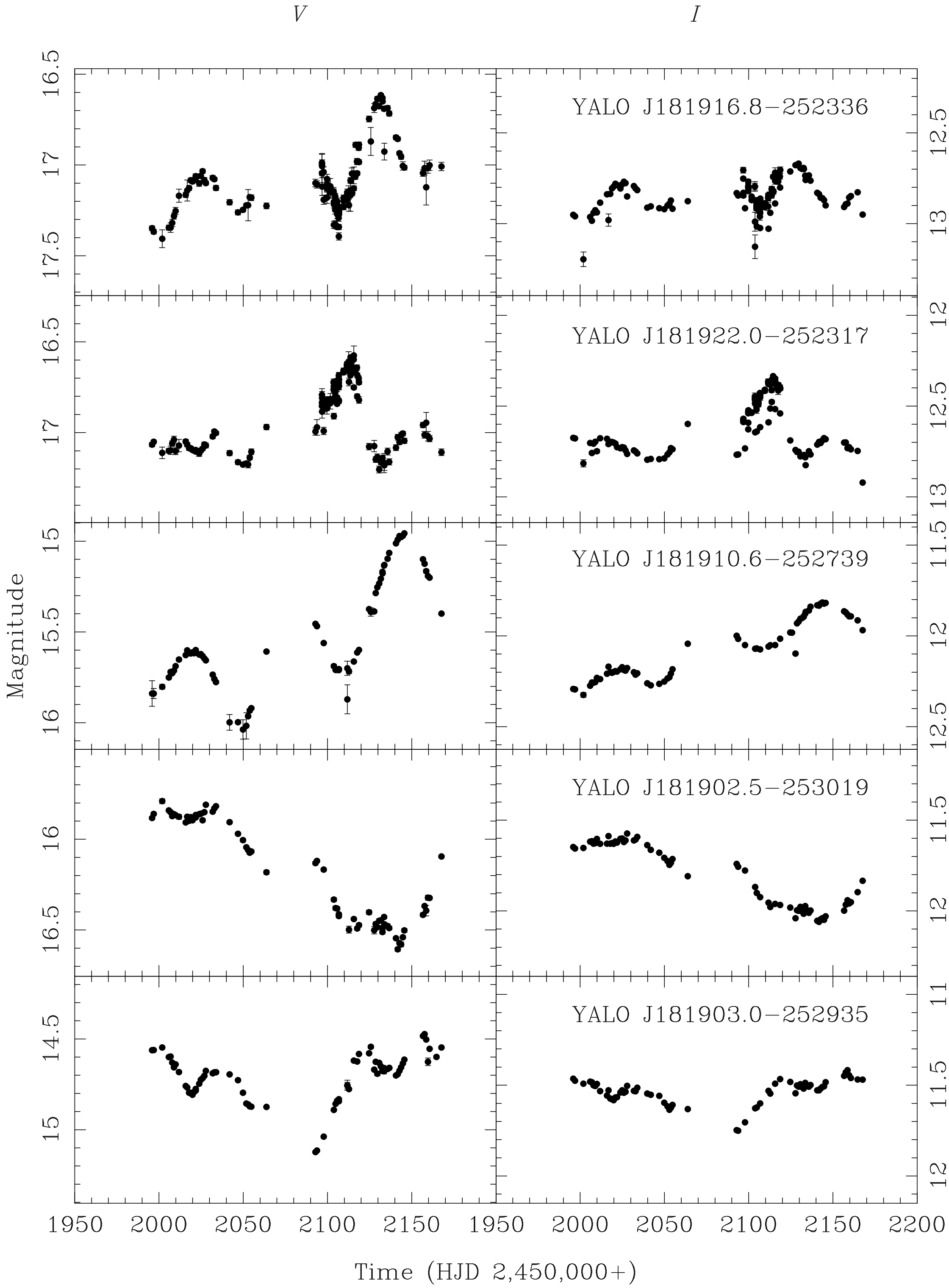

Figure 1. Light curves for five variables in V (left panel) and I (right panel).

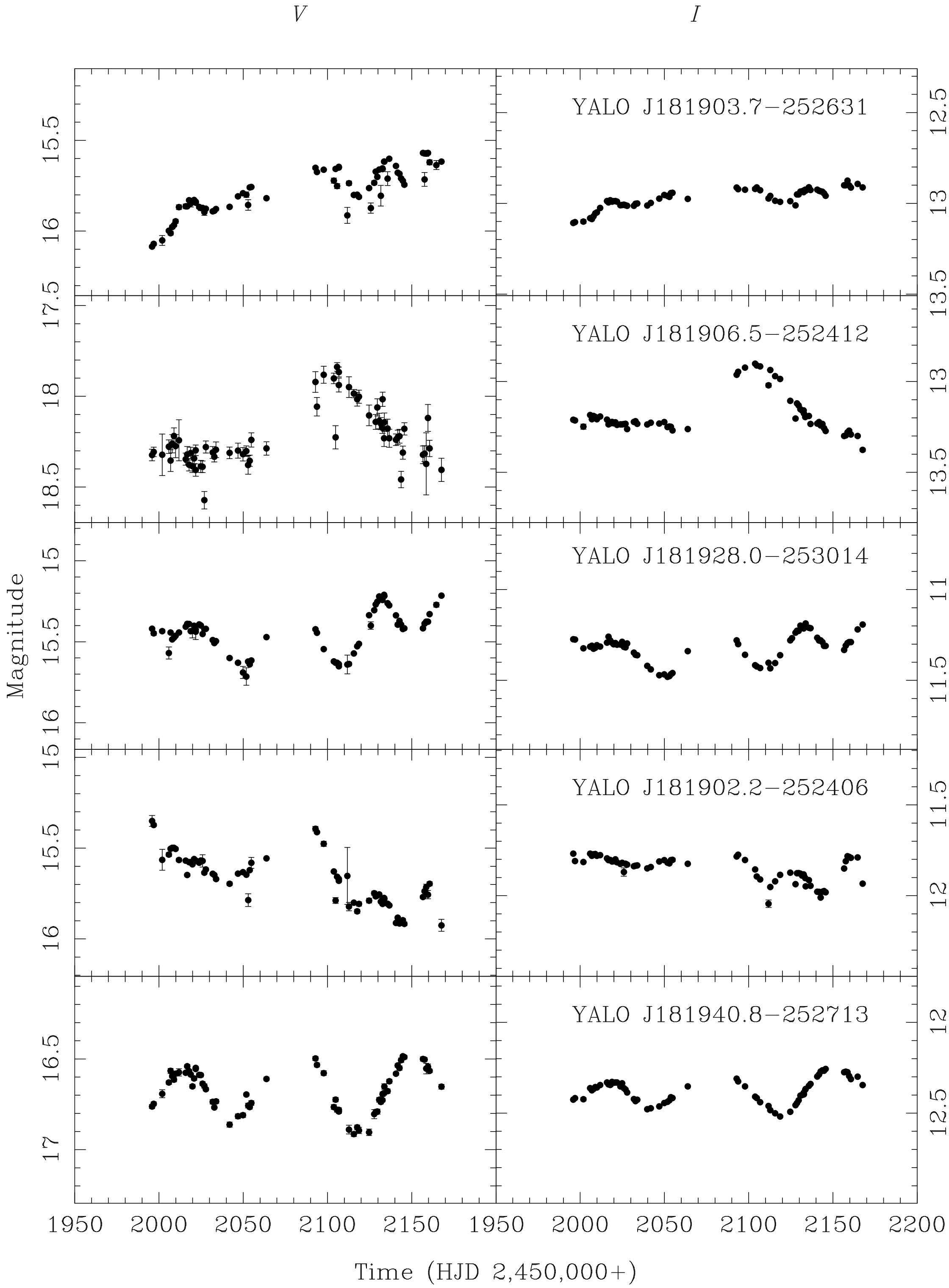

Figure 2. Light curves for five variables in V (left panel) and I (right panel).

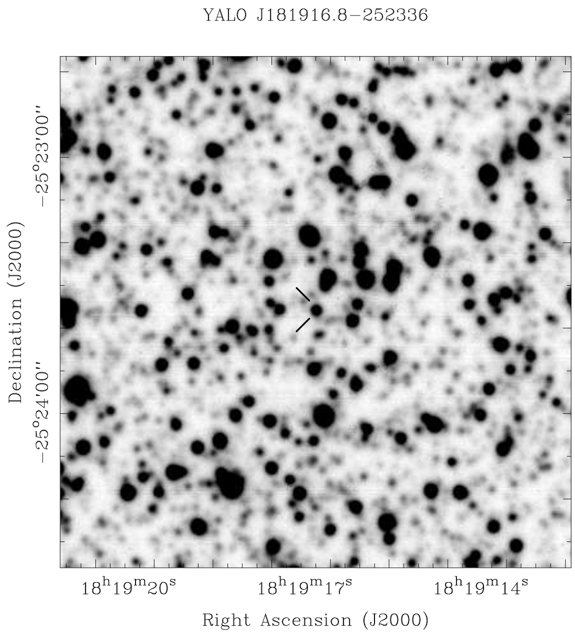

Figure 3. V-band finding chart of YALO J181916.8-252336. Source is in centre.

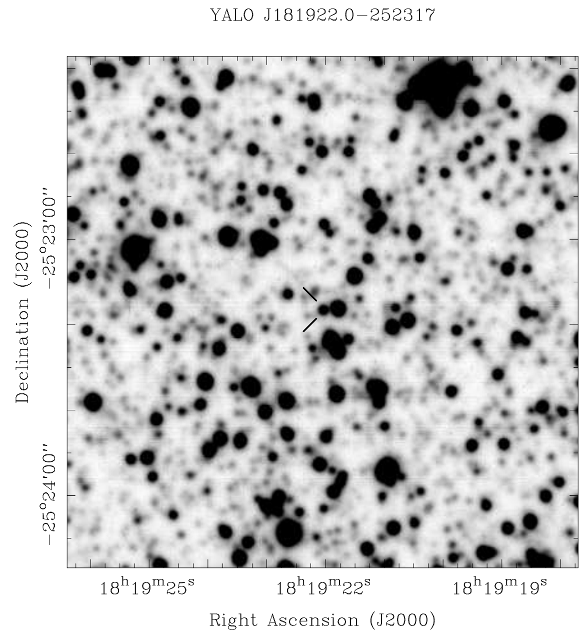

Figure 4. V-band finding chart of YALO J181922.0-252317. Source is in centre.

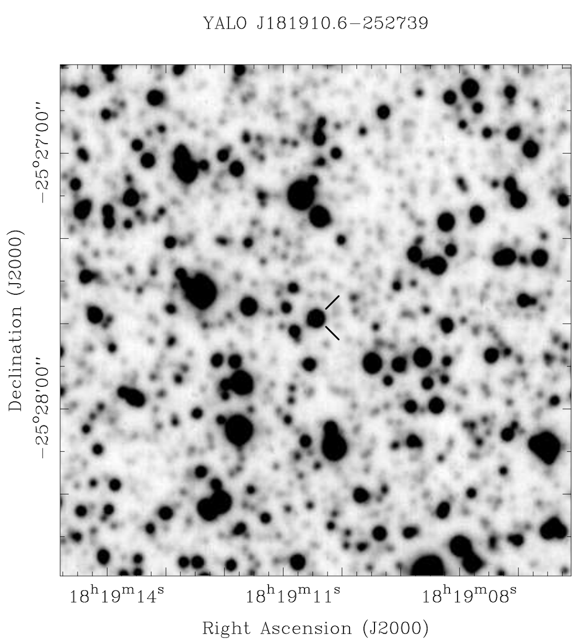

Figure 5. V-band finding chart of YALO J181910.6-252739. Source is in centre. Note: The first star to the south-east is a variable star.

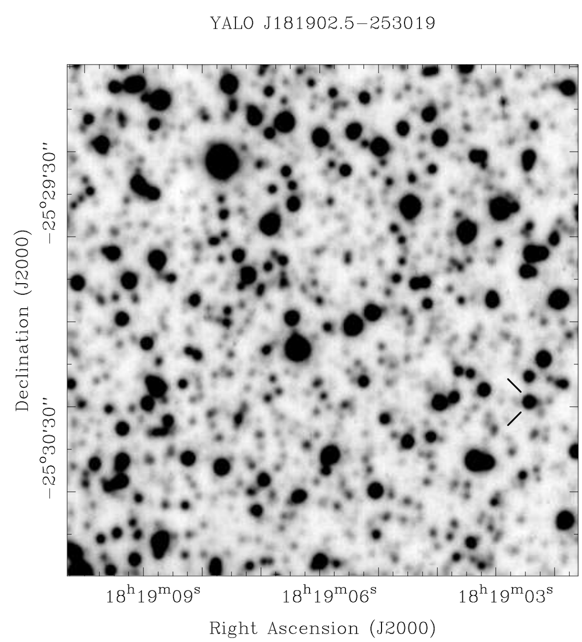

Figure 6. V-band finding chart of YALO J181902.5-253019. Source is lower-right of centre.

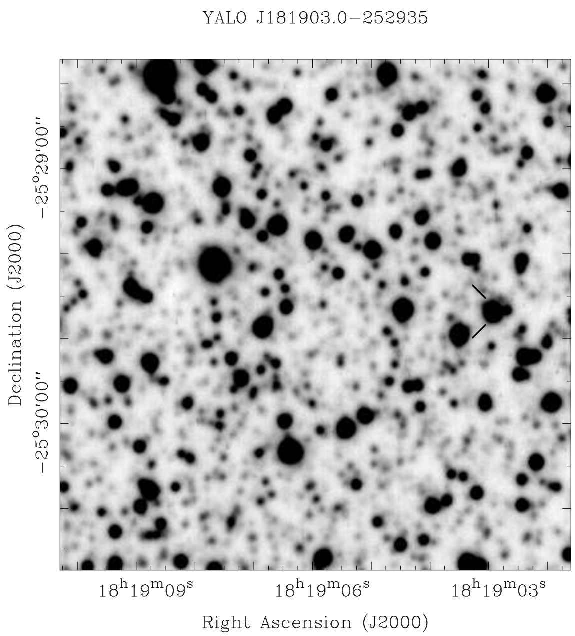

Figure 7. V-band finding chart of YALO J181903.0-252935. Source is right of centre.

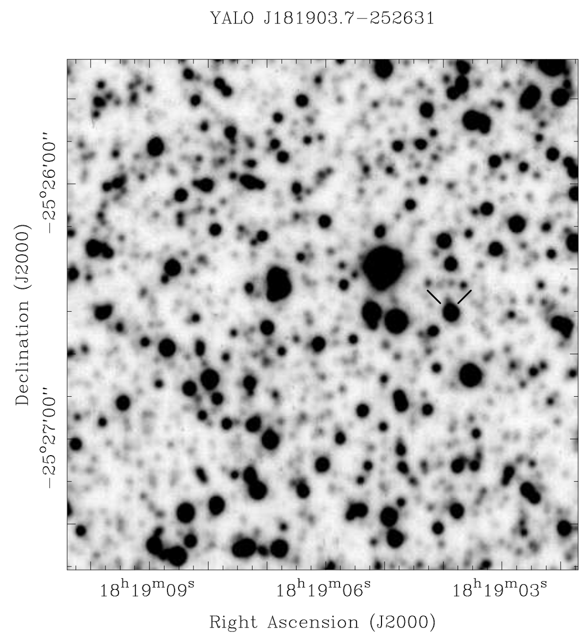

Figure 8. V-band finding chart of YALO J181903.7-252631. Source is right of centre.

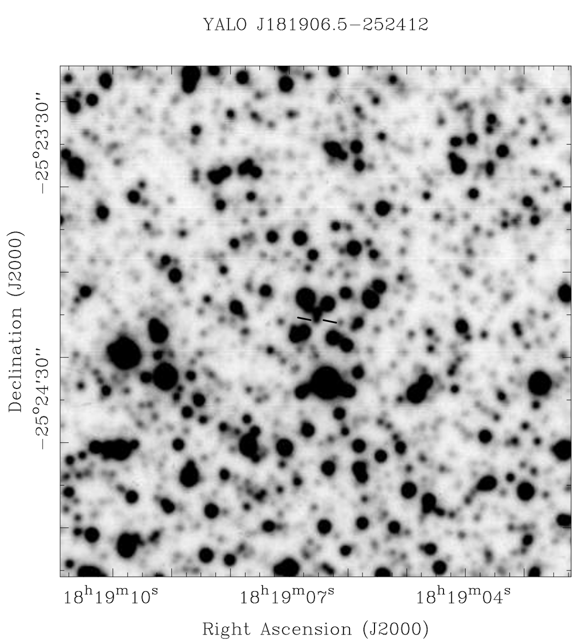

Figure 9. V-band finding chart of YALO J181906.5-252412. Source is in centre.

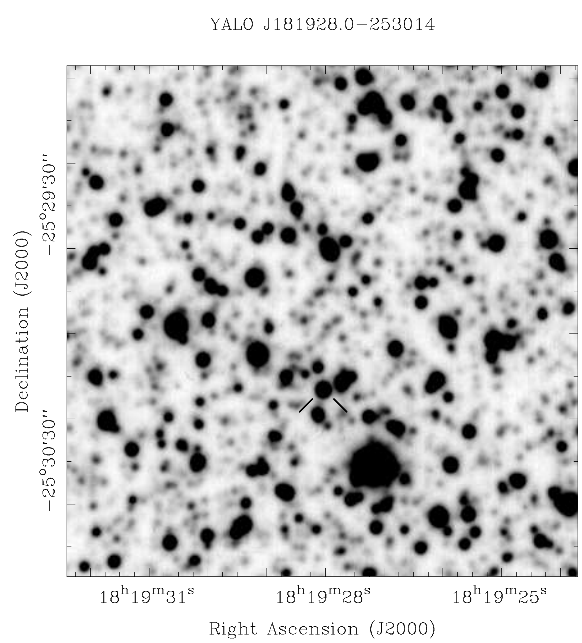

Figure 10. V-band finding chart of YALO J181928.0-253014. Source is below centre.

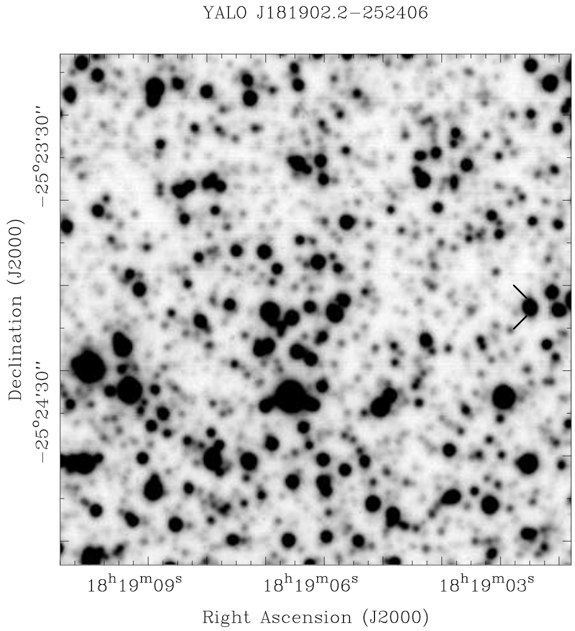

Figure 11. V-band finding chart of YALO J181902.2-252406. Source is right of centre.

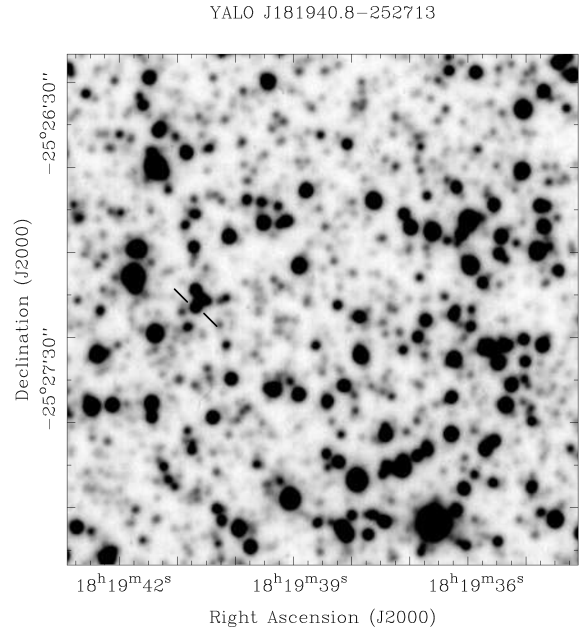

Figure 12. V-band finding chart of YALO J181940.8-252713. Source is left of centre.

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OP Aql AND V926 Aql

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Presenting accurate coordinates for all catalogued variable stars, especially for those originally announced with only approximate positional information and no finding charts, is an urgent task in our era of extensive automatic variable star surveys, and considerable effort is being dedicated to it (cf. Samus et al., 2002). In the course of a large-scale project aimed at improving positions for many variable stars discovered at Harvard Observatory (Webbink et al., 2002), a case of confusion concerning OP Aql and V926 Aql was revealed. This paper describes the circumstances and announces decisions taken by the Sonneberg Observatory and by the team of the General Catalogue of Variable Stars (GCVS) to minimize confusion.

The discovery of Harvard variable star HV 5469, of unknown type or period, was announced by Hoffleit (1932). This star was soon named OP Aql (Guthnick & Prager 1932), though it remained unstudied. The discoverer did not publish a finding chart.

Several decades later in Sonneberg, Gessner (1959) found that OP Aql was an eclipsing star with $3\overset{d}{.}227797$ period, and published a finding chart. The chart shows two variable stars, one of them labeled OP Aql, and the other one S 5341. Gessner announced the latter star as a new discovery, also an Algol, with a period of $2\overset{d}{.}97303$. Kukarkin, Efremov, & Kholopov (1960) assigned S 5341 the GCVS designation V926 Aql. Several minima have since been published for each of these two stars by amateur astronomers.

A search in the plate stacks of the Harvard Observatory, using Hoffleit's original notebooks, shows beyond doubt that the original HV 5469 is actually the star labeled S 5341 in Gessner (1959), whereas OP Aql in the same chart is a new variable discovered by Gessner.

In order to minimize further confusion, we take the following decisions.

We announce that V926 Aql = HV 5469 = S 5341, and thus OP Aql is a new eclipsing variable discovered by Gessner (1959). This is scarcely the first case of a variable star having both HV and Sonneberg Veränderlicher Stern numbers. With the designation HV 5469 transferred to V926 Aql, the finding chart in Gessner (1959) remains quite correct, and the ephemeris of each variable remains correct as published. The finding chart for OP Aql in Tsesevich & Kazanasmas (1971) also shows the right star. We give OP Aql the new Sonneberg number, S 10948. We hope that astronomers will not be taken aback by the paradox that the name "OP Aql" had been first introduced decades before the variable now called OP Aql was actually discovered. Figure 1 presents a Digitized Sky Survey finding chart of OP Aql and V926 Aql, with the relevant identifications given in the caption.

The GCVS work is supported, in part, by grants from the Russian Foundation for Basic Research (02-02-16069) and from the program of support for leading scientific schools of Russia (00-15-96627). Participation by RFW is supported in part by U.S. National Science Foundation grant AST-9618462. The Digitized Sky Survey images are provided by the Hubble Space Telescope Science Institute under support from grant NAG W-2166 of the USA Government.

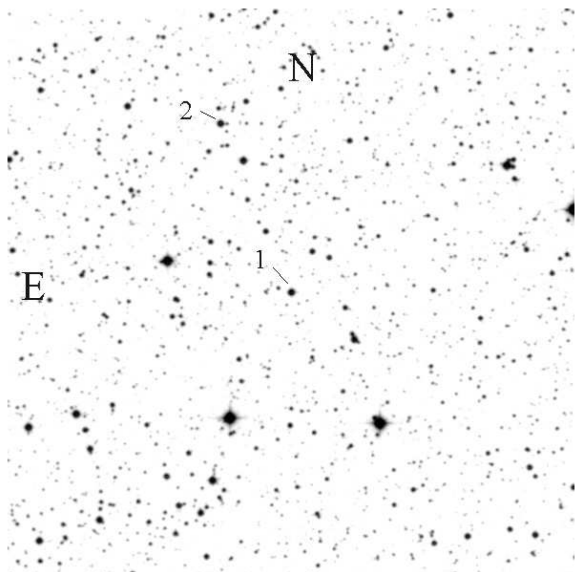

Figure 1. The photographic $10' \times 10'$ finding chart for OP Aql and V926 Aql (from the blue-light image of the Second Digitized Sky Survey). 1: OP Aql = S 10948 = GSC 1058.0287 ($19^h48^m08\overset{s}{.}3$, $+9°20'45''$, 2000.0). 2: V926 Aql = HV 5469 = S 5341 = GSC 1062.0024 ($19^h48^m13\overset{s}{.}4$, $+9°23'43''$, 2000.0).

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BVRI OBSERVATIONS OF AH Her IN THE YEARS 2000-2001

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AH Her is a dwarf nova, Z Cam subtype, that varies in magnitude between $V{=}14\overset{\mathrm{m}}{.}3$ and $V{=}11\overset{\mathrm{m}}{.}3$ (for a review, see Spogli et al. 2001).

In this paper we present the results of our observations made in the years 2000-2001 at the Astronomical Observatory of the Perugia University in the B, V, R_C, I_C photometric bands. The instruments used and the photometric techniques have been already described in Spogli et al. (1998). We used the calibration stars as reported in Spogli et al. (2001).

The data are collected in two distinct tables relative to the above-mentioned years. The observations made in 2000 are few but significant: the object was discontinuously followed for 14 nights from 18/08/2000 to 27/09/2000 (see Table 2 and Figure 1). In 2001 the variable was instead well monitored: the data collected goes from 15/07/2001 to 02/11/2001 for a total of 47 nights (see Table 3 and Figure 2). There is a gap in our observations in the month of September for the bad weather.

Table 1 shows the main characteristics of the data and improves the values reported in Spogli et al. (2001). We computed the spectral slope for AH Her using the same procedure described in Spogli et al. (1998), confirming a values ranging from $0\overset{\mathrm{m}}{.}3$ to $0\overset{\mathrm{m}}{.}7$, with a mean value equal to $0\overset{\mathrm{m}}{.}61\pm0\overset{\mathrm{m}}{.}08$. Figure 3 shows the colour-magnitude diagram for AH Her during the whole outburst cycle: the data are well represented by a linear regression, in agreement with Spogli et al. (2001).

Table 1: Photometric characteristics of AH Her during our observations.

	B	V	R_C	I_C
Maximum Outburst	11.57±0.09	11.58±0.04	11.52±0.05	11.41±0.03
Minimum of Light	14.48±0.11	14.14±0.05	13.73±0.05	13.20±0.03
Mean Values at Minimum	14.0±0.3	13.7±0.3	13.3±0.2	12.9±0.2
Outburst Amplitude	2.9	2.5	2.2	1.8
Decay Rates(mag/day)	0.25±0.04	0.22±0.04	0.17±0.03	0.14±0.03
	$(B-V)$	$(V-R_C)$	$(V-I_C)$	
Mean Values at Maximum	−0.02	0.06	0.21	
Mean Values at Minimum	0.35	0.38	0.74	

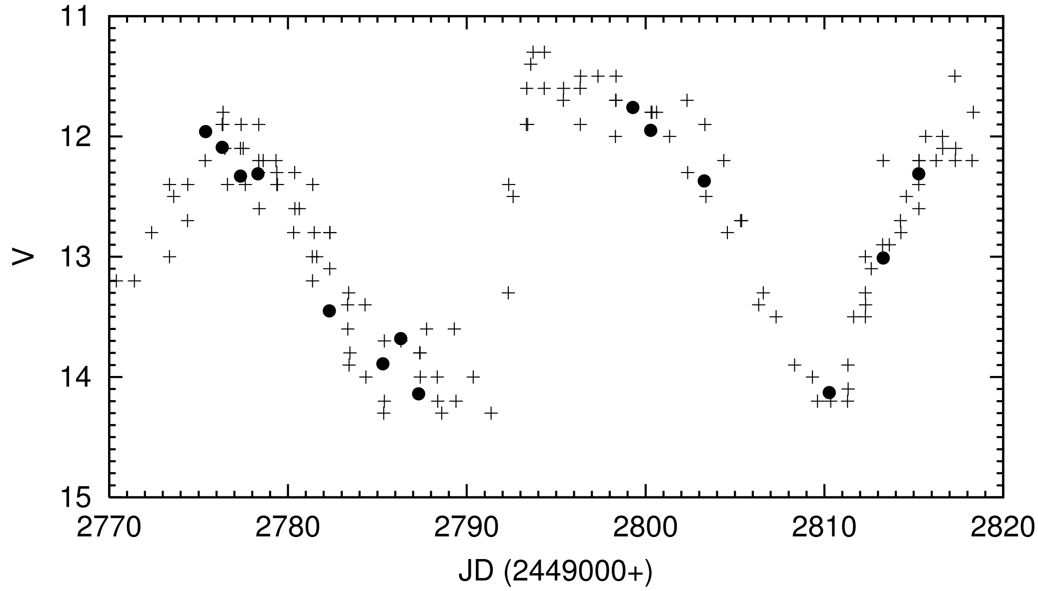

Figure 1. V light curve of AH Her during August-September 2000. Circles represent the data here reported, while crosses are visual estimates available from VSNET (`http://vsnet.kusastro.kyoto-u.ac.jp/vsnet/`)

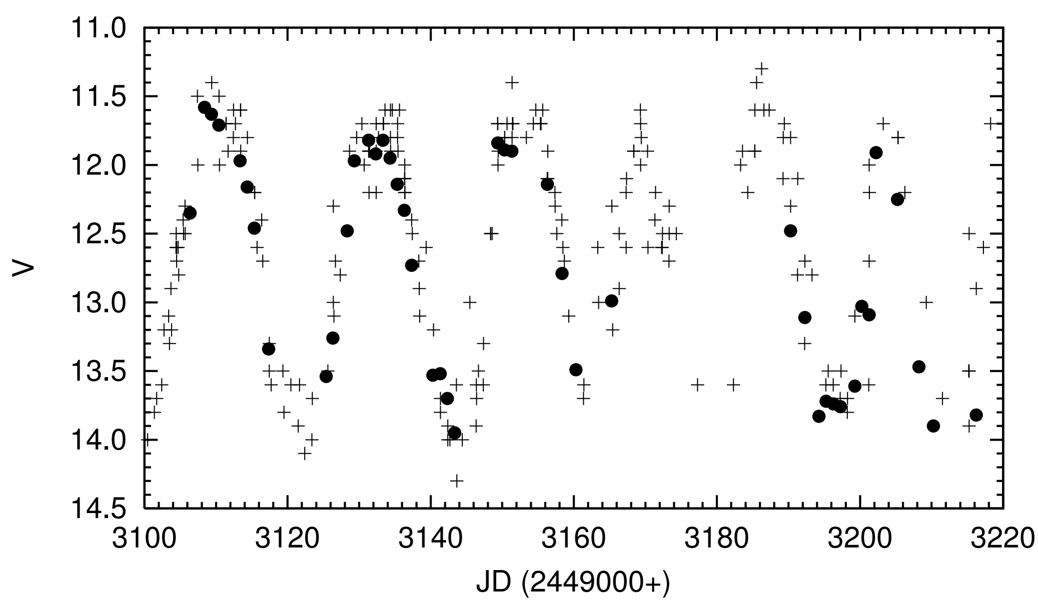

Figure 2. V light curve of AH Her during the summer-autumn 2001. Circles represent the data here reported, while crosses are visual estimates available from VSNET.

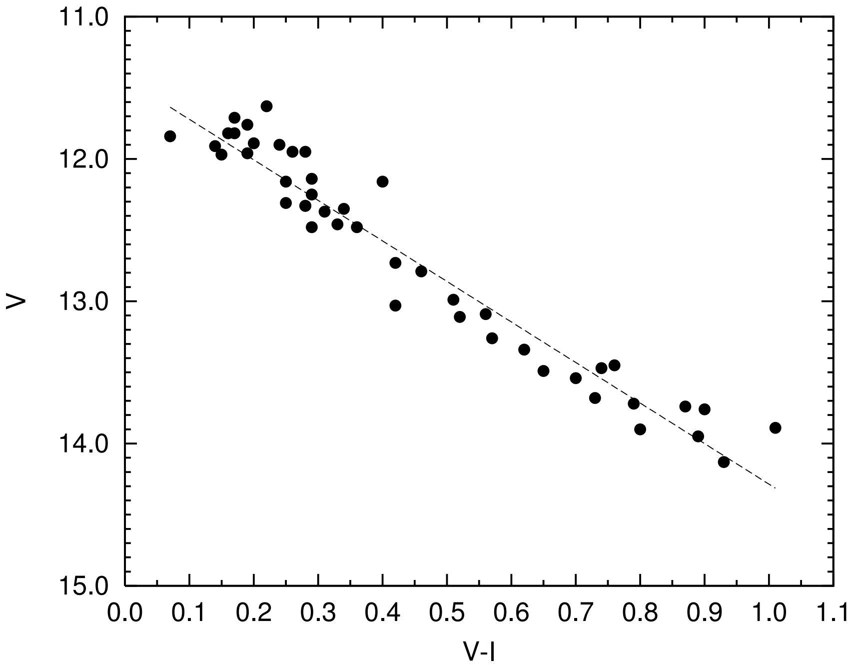

Figure 3. Colour-magnitude diagram of AH Her during 2001. The dashed line represent the linear regression.

Table 2: 2000 $BV(RI)_C$ data of AH Her

Date	JD (2449000+)	B	V	R_C	I_C
18/08/2000	2775.387	12.01±0.13	11.96±0.04	11.87±0.05	11.77±0.06
19/08/2000	2776.319	12.11±0.12	12.09±0.04	12.02±0.05	
20/08/2000	2777.344	12.19±0.12	12.33±0.03	12.17±0.05	12.05±0.04
21/08/2000	2778.314	12.66±0.14	12.31±0.09	12.40±0.07	
25/08/2000	2782.311	13.61±0.12	13.45±0.04	13.17±0.06	12.69±0.04
28/08/2000	2785.308	14.39±0.17	13.89±0.05	13.30±0.05	12.88±0.03
29/08/2000	2786.306	14.01±0.12	13.68±0.04	13.33±0.04	12.95±0.04
30/08/2000	2787.305	14.28±0.14	14.14±0.05		13.25±0.09
11/09/2000	2799.292	11.74±0.13	11.76±0.04	11.68±0.04	11.57±0.04
12/09/2000	2800.291	11.89±0.16	11.95±0.04	11.79±0.05	11.69±0.04
15/09/2000	2803.288	12.44±0.08	12.37±0.05	12.31±0.05	12.06±0.04
22/09/2000	2810.278	14.48±0.11	14.13±0.04	13.73±0.06	13.20±0.03
25/09/2000	2813.286	13.01±0.08	13.01±0.04		
27/09/2000	2815.272	12.37±0.11	12.31±0.04	12.20±0.05	12.06±0.03

References:

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Spogli C., Fiorucci M., Tosti G., Raimondo G, 2001, *IBVS*, **5147**

Table 3: 2001 $BV(RI)_C$ data of AH Her

Date	JD (2449000+)	B	V	R_C	I_C
15/07/2001	3106.375	12.26±0.05	12.35±0.03	12.23±0.05	12.01±0.04
17/07/2001	3104.392	11.57±0.08	11.58±0.04	11.52±0.05	
18/07/2001	3109.368	11.61±0.09	11.63±0.03	11.54±0.04	11.41±0.03
19/07/2001	3110.391	11.73±0.11	11.71±0.04	11.70±0.05	11.54±0.05
22/07/2001	3113.355	11.94±0.11	12.16±0.03	11.89±0.05	11.76±0.04
23/07/2001	3114.365	12.09±0.08	13.84±0.05	12.05±0.04	11.91±0.05
24/07/2001	3115.354	12.55±0.07	12.46±0.05	12.35±0.05	12.13±0.04
26/07/2001	3117.352	13.35±0.08	13.34±0.04	13.04±0.04	12.72±0.04
03/08/2001	3125.396	13.76±0.11	13.54±0.08	13.20±0.05	12.84±0.03
04/08/2001	3126.333	13.40±0.07	13.26±0.05	13.01±0.04	12.69±0.04
05/08/2001	3127.334	13.98±0.13			
06/08/2001	3128.336	12.51±0.07	12.48±0.03	12.35±0.05	12.19±0.03
07/08/2001	3129.332	12.25±0.11	11.97±0.04	11.91±0.05	11.82±0.05
09/08/2001	3131.329	12.03±0.12	11.82±0.04	11.88±0.05	11.66±0.06
10/08/2001	3132.327	11.97±0.11	11.92±0.04	11.81±0.05	
11/08/2001	3133.327	11.72±0.13	11.82±0.03	11.71±0.05	11.65±0.04
12/08/2001	3134.326	11.96±0.11	11.95±0.04	11.86±0.05	11.67±0.04
13/08/2001	3135.327	12.39±0.09	12.14±0.04	12.05±0.05	
14/08/2001	3136.323	12.41±0.11	12.33±0.04	12.23±0.05	
15/08/2001	3137.325	12.81±0.12	12.73±0.04	12.59±0.05	12.31±0.06
18/08/2001	3140.318	13.73±0.08	13.53±0.04	13.19±0.05	
19/08/2001	3141.323	13.94±0.09	13.52±0.04		
20/08/2001	3142.337	13.89±0.09	13.70±0.05		
21/08/2001	3143.358	14.36±0.11	13.95±0.03	13.49±0.06	13.06±0.04
26/08/2001	3148.302	12.26±0.16			
27/08/2001	3149.369	11.91±0.08	11.84±0.04	11.87±0.05	11.77±0.04
28/08/2001	3150.308	11.81±0.09	11.89±0.04	11.82±0.05	11.69±0.04
29/08/2001	3151.337	11.89±0.07	11.90±0.04	12.03±0.05	11.66±0.04
03/09/2001	3156.301	12.13±0.13	12.14±0.04	11.95±0.05	11.85±0.03
05/09/2001	3158.356	12.91±0.11	12.79±0.04	12.63±0.05	12.33±0.03
07/09/2001	3160.295	13.81±0.10	13.49±0.05	13.22±0.06	12.84±0.03
12/09/2001	3165.291	13.57±0.11	12.99±0.04	12.94±0.05	12.48±0.03
07/10/2001	3190.279	12.41±0.06	12.48±0.05	12.28±0.05	12.12±0.04
09/10/2001	3192.276	13.20±0.05	13.11±0.04	12.85±0.05	12.59±0.03
11/10/2001	3194.254	14.10±0.08	13.83±0.04	13.44±0.05	
12/10/2001	3195.253	13.78±0.06	13.72±0.04	13.39±0.05	12.93±0.03
13/10/2001	3196.287	14.04±0.08	13.74±0.04	13.31±0.05	12.87±0.03
14/10/2001	3197.251	14.18±0.12	13.76±0.04	13.36±0.05	12.86±0.04
16/10/2001	3199.275		13.61±0.05	13.18±0.05	12.83±0.04
17/10/2001	3200.251	13.88±0.16	13.03±0.05	13.05±0.05	12.61±0.05
18/10/2001	3201.275	13.29±0.16	13.09±0.05	12.84±0.05	12.53±0.04
19/10/2001	3202.249	11.96±0.09	11.91±0.04	11.88±0.05	11.77±0.05
22/10/2001	3205.246	12.42±0.11	12.25±0.04	12.17±0.07	11.96±0.05
25/10/2001	3208.243	13.59±0.06	13.47±0.05	13.15±0.05	12.73±0.04
27/10/2001	3210.241	14.47±0.06	13.90±0.04	13.48±0.05	13.10±0.05
29/10/2001	3212.239	14.06±0.12			12.68±0.05
02/11/2001	3216.234	13.98±0.08	13.82±0.04	13.36±0.05	

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THE NEW SHORT PERIOD EB ECLIPSING BINARY SYSTEM GSC 01343-02414

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Name of the object:
GSC 1343-2414

Equatorial coordinates:	**Equinox:**
R.A.= $06^h50^m55\overset{s}{.}83$ **DEC.=** $+22°29'21\overset{''}{.}37$	2000.0

Observatory and telescope:
Mollet Observatory, 102-mm refracting telescope
Esteve Duran Observatory, 0.6-m Cassegrain telescope

Detector:	CCD: SX, Sony ICX027BL chip

Filter(s):	V

Date(s) of the observation(s):
16 January 2002 to 14 March 2002

Comparison star(s):	GSC 01343-01988

Check star(s):	GSC 01343-02222

Transformed to a standard system:	No

Availability of the data:
Available on the IBVS website.

Type of variability:	EB

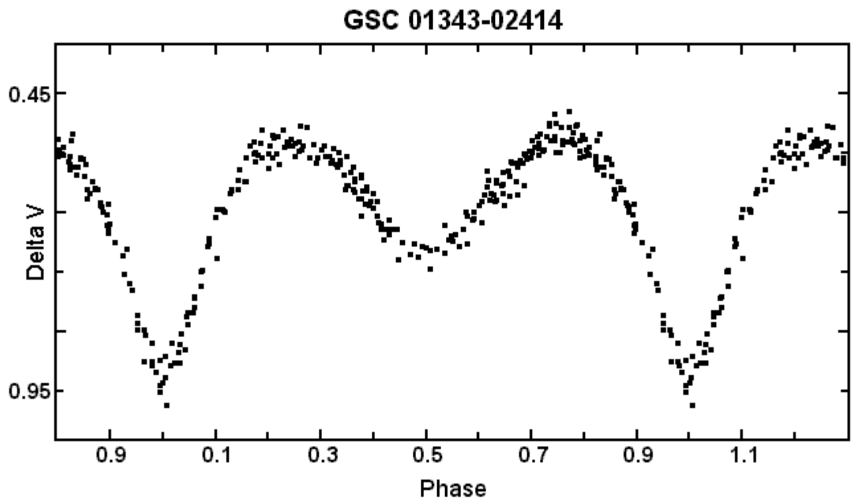

Figure 1.

Remarks:

The variability of GSC 01343-02414 was discovered during a CCD survey searching for new variable stars from Mollet Observatory from 22 November 2001 to 10 March 2002, and observed with the 0.6m Cassegrain telescope from Esteve Duran Observatory. This object is listed in the Guide Star Catalogue with a PAL-V1 photovisual magnitude of 12.61. Our observations show that GSC 01343-02414 is a new EB eclipsing binary system with a period of 0.57 days (Figure 1). The star fades 0.40 magnitudes at primary minimum and 0.19 at the secondary one. The following ephemeris was computed:

$$\begin{array}{l} \mathrm{HJD}_{\mathrm{MinI}} = 2452327^{\mathrm{d}}.425 + 0^{\mathrm{d}}.56914 \times E. \\ \qquad\qquad\qquad \pm 0.005 \quad \pm 0.00007 \end{array}$$

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THE NEW CLASSICAL CEPHEID NSV 02852

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[2] Grup d'Estudis Astronomics, Apartado 9481, 08080 Barcelona, Spain

Name of the object:
NSV 02852 = HD 252611 = S 09193 = GSC 01877-00245

Equatorial coordinates:	**Equinox:**
R.A.= $06^h10^m19\overset{s}{.}34$ **DEC.=** $+24°01'15\overset{''}{.}24$	2000.0

Observatory and telescope:
Els Hostalets de Pierola Observatory, 0.4-m Newtonian telescope
Esteve Duran Observatory, 0.6-m Cassegrain telescope

Detector:	CCD: SX, Sony ICX027BL chip

Filter(s):	V

Date(s) of the observation(s):
1 October 2001 to 19 February 2002

Comparison star(s):	GSC 01877-00086

Check star(s):	GSC 01877-00864

Transformed to a standard system:	No

Availability of the data:
Upon request.

Type of variability:	Cep

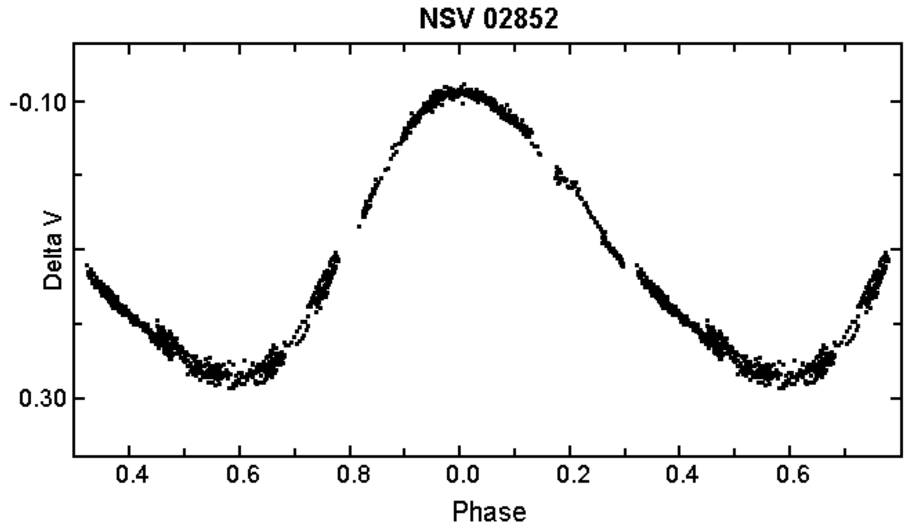

Figure 1.

Remarks:
The variability of NSV 02852 was first discovered by Hoffmeister (1966) and listed in the NSV catalogue (Kholopov, 1982), as an unstudied variable with rapid light changes. In the Henry Draper Catalogue (Cannon and Pickering, 1918-1924) this star is included with a photographic magnitude of 10.80 and and A0 spectral type. Our observations show that NSV 02852 is a classical Cepheid variable with an amplitude of 0.38 magnitudes and a period of 2.14 days (Figure 1). The following ephemeris was computed: $$\mathrm{HJD}_{\mathrm{MinI}} = 2452234\overset{\mathrm{d}}{.}46 + 2\overset{\mathrm{d}}{.}1371 \times E.$$ $$\pm 0.02 \quad \pm 0.0007$$

References:

Cannon, A.J., and Pickering, E.C. 1918-1924, *The Henry Draper Catalogue*, Ann. Astron. Obs. Harvard College, **91-99**

Hoffmeister, C., 1966, *AN*, **289**, 3, 139

Kholopov, P. N., editor, 1982, *New Catalogue of Suspected Variable Stars*, Moscow

ERRATUM FOR IBVS 5278

The epoch that was given for the new classical Cepheid NSV 02852 is the time of maximum, so the ephemeris is:

$$HJD Max = 2452234.46 + 2.1371 \times E$$

The correct reference of Cannon & Pickering:

Cannon, A.J., and Pickering, E.C. 1918-1924, The Henry Draper Catalogue and Extension, Ann. Astron. Obs. Harvard College, 91-100

(Although HD252611 is in the Henry Draper Catalogue, it was actually published in the HD catalogue extension.)

Enrique Garcia-Melendo

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SHORT PERIOD VARIABILITY OF THE ALGOL SYSTEM AI Dra

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We performed photometric observations of AI Dra on two nights and detected short period variability. AI Dra (A0V+F9; Brancewicz and Dworak 1980) is one of the well-known Algol-type eclipsing binary systems. As this system is bright ($m_v = 7.05 - 8.09$) and of short orbital period (P=1.988day), many reports of photometric observations have been presented.

Recently, photoelectric photometry covering the whole phase of AI Dra was carried out by Değirmenci et al. (2000) at B and V bands. They found "collapses" at both shoulders of the primary minima in both colors and they pointed out that these anomalies would be due to the gas stream flowing from the secondary to the primary component. The Wilson-Devinney analysis of the light curves yielded a semi-detached configuration.

We performed photoelectric observations of AI Dra with the 60cm reflector of Nishi-Harima Astronomical Observatory in the B and V band-passes similar to the standard Johnson system. The telescope is equipped with the photon-counting photometer (AES PCPA2) at its Cassegrain focus. The photomultiplier tube R647p of HAMAMATSU Photonics was used. The star HD 154199 was chosen as the comparison. This star was also used by Değirmenci et al. (2000).

We have detected periodic oscillations with an amplitude of about $0.03 - 0.05$ mag outside eclipses. The light curves obtained on 5 Aug. 2000 in the B- and V-bands are shown in Fig. 1. The heliocentric phase calculated according the ephemeris by Değirmenci et al. (2000) were from 0.688 to 0.782. On 7 Sep. 2000 (heliocentric phase $0.152 - 0.186$), we have also detected the light variations which covered less than one period (Fig. 2). We adapted the PDM analysis (Widjaya, 1996) to these data, and a periodicity of $0\overset{d}{.}034$ was found in both passbands.

To study the correlation between brightness and color, we use the difference from the mean B magnitude of each night, ΔB, and the difference from the mean color, $\Delta(B-V)$. We plot $\Delta(B-V)$ versus ΔB in Fig. 3. The data fit to the relation $\Delta(B-V) = 0\overset{m}{.}384\ \Delta B$, with a correlation coefficient of 0.784. The star is bluer in its brighter phase. This corresponds to the property of stellar pulsation.

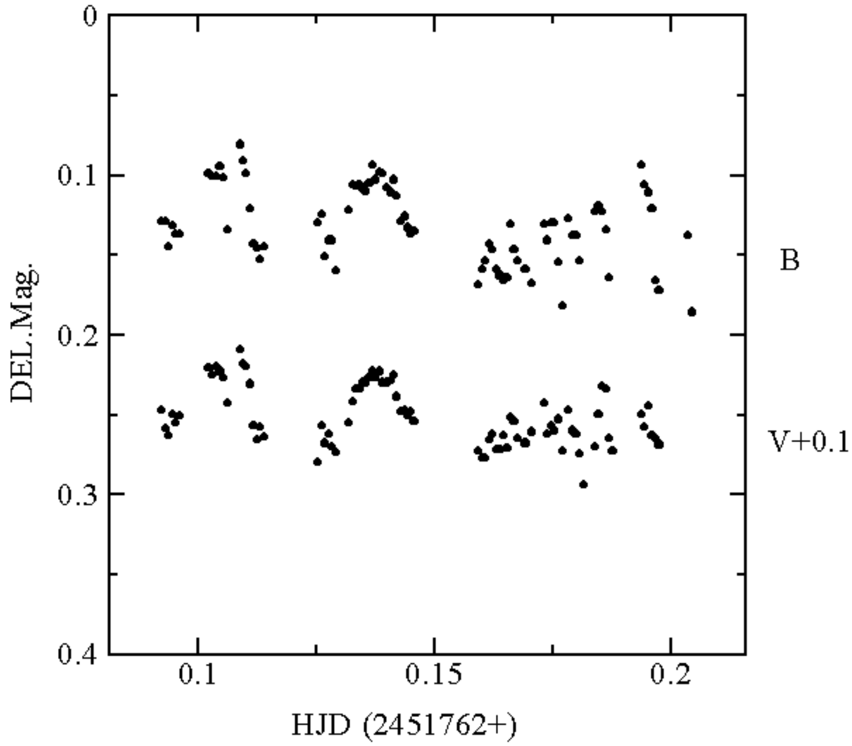

Figure 1. Observed oscillations on 5 Aug. 2000.

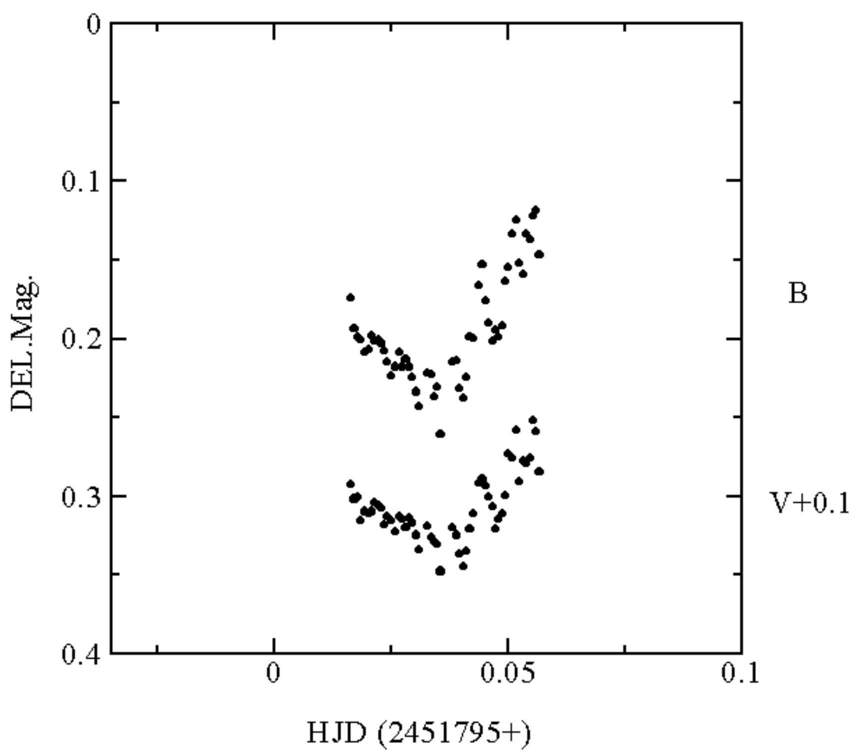

Figure 2. Observed oscillations on 7 Sep. 2000.

Adapting the M = 3.40 $M_\odot$ and R = 2.39 $R_\odot$ (Değirmenci et al. 2000) we determined the mean density of the primary $\rho = 0.25\ \rho_\odot$. that gives the pulsation constant Q $\simeq$ 0.02. This value and the observed amplitude suggest lower mode of non-radial oscillation.

The spectral type A0 of AI Dra is in the range of the δ Sct type stars listed by Rodriguez (2000). Five A0 stars are found in the list. Bolometric magnitude and bolometric correction of primary component of AI Dra is 0.60 and −0.25, respectively (Değirmenci et al. 2000). That gives Mv = 0.85. This value almost corresponds with the period-luminosity relation of δ Sct stars (Breger 1979). Based on these characteristics, we suggest that AI Dra is a δ Sct star.

We wish to express our thanks to Tomomi Shimizu, Yumi Narusawa, Taku Nakajima, Noriyoshi Nakamoto, Osamu Ohshima, Seiichiro Kiyota and Shinobu Ozaki for their help.

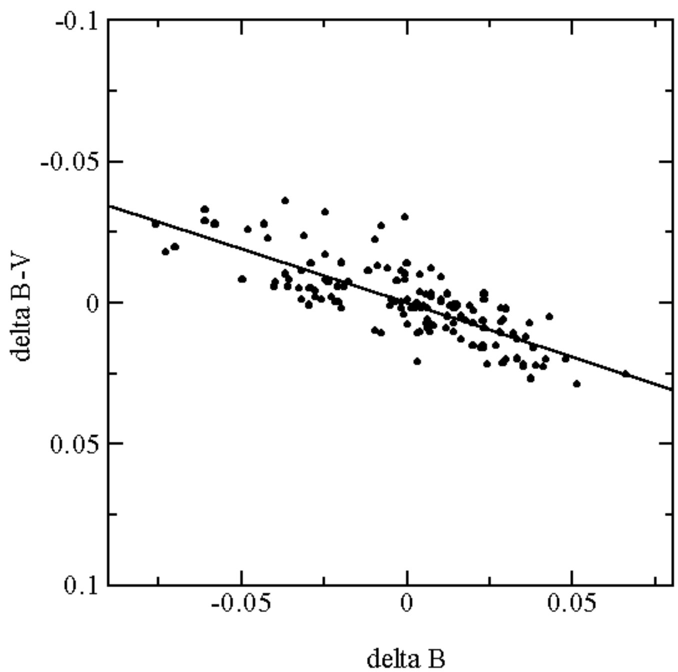

Figure 3. Color-magnitude diagram of the short-period variability on the two nights. The horizontal axis indicates ΔB, and the vertical axis indicates $\Delta(B-V)$.

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V357 Her: ANOTHER W UMa-TYPE ECLIPSING BINARY MISCLASSIFIED AS HADS

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The variable V357 Her (preliminary designation S 4350 Her) was discovered photographically by Götz and Wenzel (1956). These authors derived five times of maximum light and a period of 0.139725 d. Considering the period and the shape of the light curve, the star was classified as an RR Lyrae-type variable, reclassified later as a high-amplitude δ Scuti (HADS) star.

Not only for V357 Her, but also for some other stars classified as HADS, either there are no observations since the time of discovery or the observations are very scarce. With CCD cameras, accuracy of 0.01 mag is easily achieved, so the true nature of these stars can be verified even with a small telescope. This prompted us to carry out CCD observations of some poorly studied stars classified as HADS. The two stars we observed a few years ago, UW CVn (Kopacki and Pigulski 1995) and V879 Aql (Kopacki and Pigulski 1998) appeared to be W UMa-type eclipsing binaries. Continuing this program, one of us (A.B.) observed V357 Her during six nights in 2001. The new photometry shows clearly that V357 Her is a W UMa-type eclipsing binary as well. This was already suggested by Schmidt et al. (1995), but because their conclusions relied on only 15 V and R-filter data points covering mainly the vicinity of the maximum light, the star was still present in the newest catalogue of δ Scuti stars (Rodríguez et al. 2000).

It should be noted that a program of observing neglected HADS is now conducted also by another group of observers (Van Cauteren and Lampens 2001 and references therein) and resulted in some reclassifications too.

The new photometric observations of V357 Her have been carried out during six nights between May 21 and August 2, 2001, in the observatory of the Institute of Experimental Physics of the University in Białystok. The telescope was 30-cm Meade LX 200 Schmidt-Cassegrain equipped with a Pictor 416 XTE CCD camera of 768 $\times$ 512 pixels covering a $7\farcm7 \times 5\farcm1$ field-of-view. No filter was used and the exposure time was 60 seconds for all frames. A total of 377 frames have been taken. They were calibrated in a standard way and then the magnitudes of stars were derived by means of the Daophot package of Stetson (1991).

In order to know the colours of nearby stars, the field of V357 Her was also observed on one night, August 11, 2001, in the Białków Observatory of the Wrocław University. The same equipment and filters as described by Kopacki and Pigulski (1998) were used.

In total, five V-filter and five I_C-filter frames with 100-s exposure time were taken. The resulting colour-magnitude diagram helped us to choose the comparison stars. Moreover, since Białków filters match the Johnson V and Cousins I_C passbands quite well, using the colour difference between a red and a blue star from the field, we found the effective wavelength of the Białystok observations to be 670 nm. This value was used later in the fits.

Prior to the analysis, some datapoints with largest errors have been rejected and the remaining 322 differential magnitudes of V357 Her with respect to two nearby comparison stars of similar colour index have been formed. These differential magnitudes are plotted in the phase diagram in Fig. 1. The magnitudes are available through the IBVS web site as a 5280-t2.txt file.

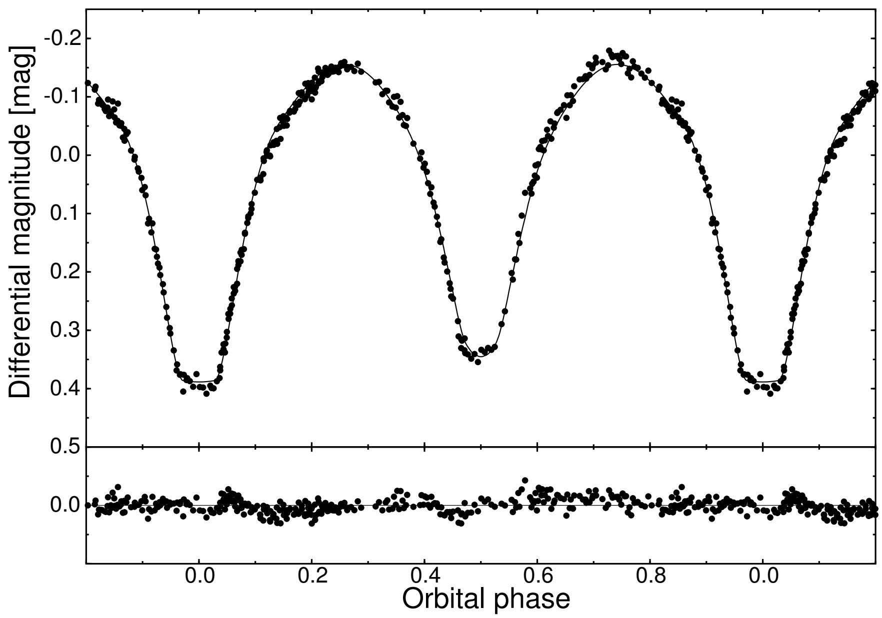

Figure 1. Differential Białystok CCD observations of V357 Her (dots), phased with the period of 0.28204111 d. The solid line is the synthetic light curve corresponding to the best solution given in Table 3. Below, the residuals from the fit are plotted in scale.

Table 1. Times of the primary minimum of V357 Her

Time of minimum HJD 2 400 000.+	Epoch E	$O-C$ [d]	Source of data
48 535.6087 ± .0013	0	0.0000	Schmidt et al. (1995)
52 051.5332 ± .0002	12466	0.0000	this paper
52 055.4823 ± .0004	12480	+0.0005	this paper
52 061.4050 ± .0005	12501	+0.0004	this paper
52 066.4812 ± .0004	12519	−0.0002	this paper
52 076.3518 ± .0005	12554	−0.0010	this paper
52 124.5818 ± .0003	12725	0.0000	this paper

The preliminary value of the orbital period has been obtained by means of the Fourier periodogram. Using Wilson-Devinney (WD) code (Wilson and Devinney 1971; Wilson 1991) we next derived the preliminary synthetic light curve, which was fitted to the observations of each of the six nights separately. The times of minimum derived from these fits are given in Table 1.

In addition, we recalculated the time of minimum light for Schmidt et al. (1995) data, using the same procedure. Since these observations were made in two filters, V and R, the corresponding entry in Table 1 is the mean of the minimum in V and R.

A linear regression of all times of minimum light given in Table 1 with weights inversely proportional to the r.m.s. errors, yielded the following ephemeris (the number in parentheses denotes the r.m.s. error of the last digits):

$$\mathrm{T_{min}\,I} = \mathrm{HJD}\,2448535.6087(15) + 0.28204111(12) \times E, \qquad (1)$$

where E is the number of cycles elapsed from the initial epoch. The $O-C$ values listed in Table 1 were calculated with this ephemeris.

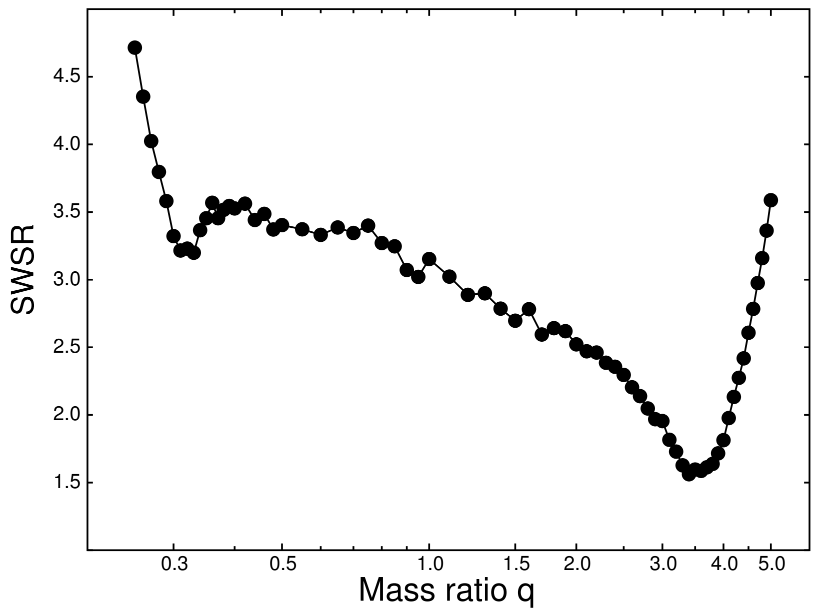

Figure 2. The smallest values of the sum of weighted squares of the residuals (SWSR) plotted as a function of the assumed mass ratio q.

Having refined the value of the orbital period, we tried to derive the parameters of the system. In order to do this, we used the WD differential correction program. Each data point was assigned a weight proportional to the reciprocal of square of the Daophot error. Since for V357 Her the mass ratio, $q = M_2/M_1$, is not known, it was derived first from the WD fits in a most common way, that is, from a series of the best fits with assumed value of q. Fig. 2 shows the results of the fits, where we used the sum of weighted squares of the residuals (SWSR) as the indicator of the quality of the fit. In these calculations we assumed the overcontact geometry and the mean surface temperature of star 1 (star 1 is, by definition, eclipsed near phase 0.0), T_1 = 4800 K. Moreover, bolometric albedos, $A_1 = A_2 = 0.5$ (Ruciński 1973) and gravity darkening coefficients, $g_1 = g_2 = 0.32$ (Lucy 1967) were adopted. Limb darkening coefficients, $x_1^{\mathrm{bolo}} = x_2^{\mathrm{bolo}} = 0.54$ and $x_1 = x_2 = 0.66$ for λ_{eff} = 670 nm were taken from the tables presented by Van Hamme (1993). The calculations were performed for q in the range between 0.25 and 5.0 (Fig. 2). Only five parameters were iterated: phase of the primary conjunction, ϕ_0, inclination, i, average temperature of star 2, T_2, surface potential, $\Omega_1 = \Omega_2$, and relative monochromatic luminosity of star 1, L_1. Since for some q there were problems with convergence, 200 iterations were performed for each q and then the solution with lowest SWSR was adopted as the best. The lowest values of SWSR achieved during 200 iterations are plotted in Fig. 2. It is clearly seen that the smallest SWSR, that is, the best solution, is obtained for $q \approx 3.5$.

Table 3. Parameters of the best-fit synthetic light curve of V357 Her

Parameter	Value
Inclination, i	$83.^\circ1 \pm 0.^\circ3$
Effective temperature of star 1, T_1	4800 K (assumed)
Effective temperature of star 2, T_2	4577 ± 5 K
Surface potential, Ω_1 ($= \Omega_2$)	7.295 ± 0.005
Mass ratio, q	3.572 ± 0.006
Relative luminosity of star 1 at $\lambda_{\rm eff} = 670$ nm, $L_1/(L_1 + L_2)$	0.2880 ± 0.0012
Overfill factor, $f = (\Omega_{\rm in} - \Omega_1)/(\Omega_{\rm in} - \Omega_{\rm out})$	0.11 ± 0.02

In order to get the final solution we started iterations with the solution for $q = 3.5$ setting q as an additional free parameter. In addition, we increased the number of the grid elements on the components' surfaces and used model atmospheres in computing monochromatic fluxes. The final solution is given in Table 3. Please note, that the WD code underestimates the errors (see e.g., Maceroni and Rucinski 1997), so the errors in Table 3 should be at least doubled in order to be realistic. The synthetic light curve is overplotted in Figure 1. One can see that the residuals are not perfectly flat and some systematic differences do remain. We have checked the differential magnitudes between other bright stars in the field of V357 Her and found that the changes at this level can be attributed to some instrumental effects. The standard deviation of the residuals equals 0.013 mag.

In V357 Her the hotter component is smaller and it is occulted in the primary (deeper) minimum. The temperature difference is large ($\sim$ 220 K) indicating a poor thermal contact.

Using the positions of 11 stars from the Hubble *Guide Star Catalogue*, we derived the equatorial coordinates of V357 Her with an accuracy to within $0.''2$: $\alpha_{2000.0} = 18^{\rm h}44^{\rm m}31.^{\rm s}86$, $\delta_{2000.0} = +12^\circ 55' 31.''1$.

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EUVE J2244–15.9: A NEW SPECTROSCOPIC BINARY

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Over 40% of the sources in EUV surveys have been identified as late-type stars (e.g. the Second EUVE Catalog; Bowyer et al. 1996; ROSAT 2RE catalog, Pye et al. 1995). EUVE J2244−15.9 (HD 215341) was discovered as a spectroscopic binary in our optical observations of late-type stars selected from EUVE all-sky survey catalogs, including the Lampton et al. (1997) catalog of fainter EUVE all-sky sources jointly detected with the ROSAT PSPC. The Lampton et al. catalog concentrated on detections in the EUVE Lexan band which is centered on 100 Å.

Our optical observations were searching for chromospheric activity indicators, such as Ca II H&K and Hα in emission in a sample of EUV-selected late-type stars. We observed EUVE J2244−15.9 for 1 hour on 5 and 6 of August 1997 using the 24 inch coudé auxiliary telescope (CAT) and the Hamilton echelle spectrograph (Vogt 1987) at Lick observatory. We used a 2048 × 2048 CCD binned 2 × 2 with a dispersion of 0.033 Å/pixel at Ca H and K and 0.054 Å/pixel at Hα; the resulting velocity resolution is 7.5 km/s. Spectra were wavelength-calibrated with Th-Ar spectra and flat-fielded with quartz lamps. The observation log and line emission equivalent widths (eqw) from both components are presented in Table 1.

Table 1. EUVE J2244−15.9 Log

RA (J2000)	21 44 38
Dec (J2000)	−15 56 32
m_v	9.3
Sp. Type	dK1/2e
Obs. dates:	05/08/97 10:31:48 UT
	06/08/97 09:39:22 UT
Exp. (sec)	3600 (×2)
Ca K (eqw)	4.0 Å
Ca H (eqw)	2.1 Å
Hα (eqw)	0.4 Å
EUVE Lexan cts/s	0.028
EUVE Obs. Flux	3.9×10^{-12}
	(ergs cm^{-2} sec^{-1})

The optical spectrum of EUVE J2244−15.9 clearly shows the tell-tale signs of emission lines from a spectroscopic binary. We show a Ca H&K and Hα spectra in Figure 1. We calculated the observed flux using a coronal emissivity model with log(T) = 6.8 as described in Mathioudakis et al. (1995). We then calculated a measure of the coronal efficiency, L_{euv}/L_{bol}. We find EUVE J2244−15.9 with $L_{euv}/L_{bol} \approx 10^{-3}$, and this is at the upper end of active late-type stars found in the EUVE and ROSAT all-sky surveys (e.g. Christian and Mathioudakis 2002; Jeffries & Jewell 1993). EUVE J2244−15.9 merits further observations as a coronally active late-type binary.

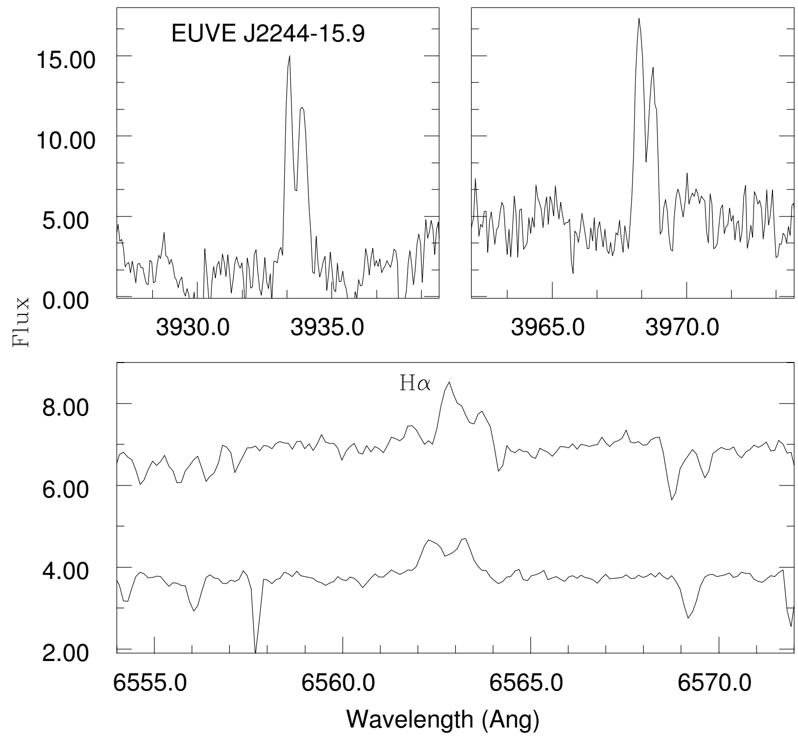

Figure 1. Ca H&K and Hα spectra of spectroscopic binary, EUVE J2244−15.9 (flux in units of 10^{-13} ergs cm^{-2} sec^{-1} Å^{-1}). (*Top*) panel shows Ca K on left and Ca H on right from the August 06 observation. (*Bottom*) panel shows the Hα spectra from August 05 and 06 August (upper Hα spectrum scaled by a factor of 1.5).

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ERRATUM TO IBVS NO. 4855 AND TIMES OF MINIMA OF THE ECLIPSING BINARY V357 PEGASI

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Observatory and telescope:
16″ Cassegrain telescope at TUBITAK† National Observatory.

Detector:	SSP-5A photoelectric photometer, Hamamatsu 4457 pmt.

Method of data reduction:
Reduction of the data were made in the usual way.

Method of minimum determination:
Times of minima were determined by the method of Kwee and van Woerden

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
V357 Peg	EW	23 45 35	+25 28 52	HIP 116688	48500.3159	0.578452	1

Source(s) of the ephemeris:
1. The Hipparcos & Tycho Catalogues (ESA, 1997)

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
V357 Peg	51810.4986	0.0004	II	U,B,V,R	−0.0007	This work
	51812.5233	0.0005	I	U,B,V,R	−0.0006	This work
	51817.4412	0.0010	II	U,B,V,R	0.0005	This work
	51819.4662	0.0010	I	U,B,V,R	0.0009	This work

†TUBITAK : The Scientific and Technical Research Council of Turkey

Remarks:

There is an error in Table 1 in Keskin et al. (2000), in the minima types (primary or secondary) of the V357 Peg. Type I (as primary min.) should have been type II (as secondary min.) and vice versa. The results of this error are: a) the light elements for min I given in Table 2 in Keskin et al. (2000) should have been for Min II b) this confusion of minima types caused Yasarsoy et al. (2000) to reach a wrong conclusion to point out that the secondary minima of the system are deeper than the primary minima. The authors have admitted the confusion that they committed in private communications.

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Yasarsoy, B., Sipahi, E., Keskin, V., 2000, *IBVS*, No. 4866

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BVRI PHOTOMETRY OF THE TYPE Ic HYPERNOVA SN 2002ap

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Supernova (SN) 2002ap in M74 was discovered by Y. Hirose and confirmed by Kushida and Li on January 29 and 30, 2002 (Nakano et al., 2002). The SN was immediately recognized as a "hypernova" from its broad spectral features (see Mazzali et al. 2002 for references). SN 2002ap was discovered very soon after it exploded, as the SN was not detected in a January 25 observation (Nakano et al., 2002). In this note we present the $BVRI$ photometric observations of SN Ic 2002ap at maximum and during the fast-decline phase after maximum brightness. Also, we briefly discuss our main results.

At the Center for Backyard Astrophysics-Concord (CBA) with 44 cm reflector and at Pulkovo Observatory (PO) with 10 cm refractor we monitored SN 2002ap in VRI and BVR passbands, respectively. Both telescopes were equipped with CCD-cameras. All CCD observations were reduced in the standard fashion, with dark current subtraction and flat-field correction using MIDAS package for PO data and AIP4WIN for CBA data. As the SN is isolated and contamination of the photometry by the background galaxy light is negligible we used aperture photometry on the SN nearby bright stars. The photometric data of nine bright stars in the field of M74 provided by Henden (2002) were used for absolute calibration. The final $BVRI$ magnitudes for SN are given in Table 1. We estimate the accuracy of our photometry at $0\overset{m}{.}03$ for CBA data and at $0\overset{m}{.}1$ for PO data. The errors in the absolute zero point determination are smaller than 3%.

To check the data, we have compared our photometry with the measurements of Gal–Yam et al. (2002), Riffeser et al. (2002), Yohii et al. (2002) and find excellent agreement. On the other hand, we have found some discrepancy with observations of Borisov et al. (2002). A comparison of $BVRI$ data given by Borisov et al. (2002) with Gal–Yam et al. (2002) and our measurements shows that the B magnitudes obtained with the Schmidt telescope tends to fall below the data of Gal–Yam et al. (2002). The V magnitude obtained with the 60-cm Cassegrain telescope is brighter by $0\overset{m}{.}1$ mag. Also, the I magnitudes given by Borisov et al. (2002) are systematically brighter than Gal–Yam et al.'s (2002) and our results with the maximum discrepancy of $0\overset{m}{.}35$ magnitude. In the following we do not take into account these discrepant data. The R magnitudes are in the good agreement with our results. Unfortunately, Borisov et al. (2002) used only one comparison star for differential photometry and, probably, they did not correct the $BVRI$ data for the color terms for different telescopes.

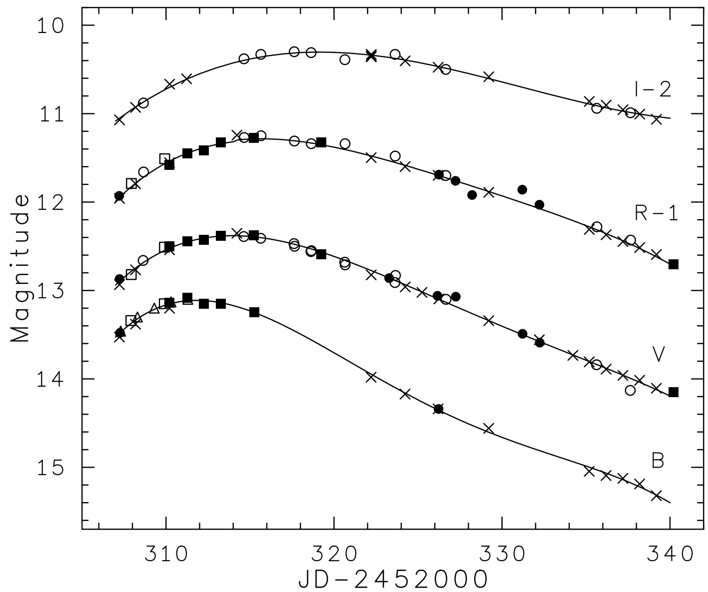

Figure 1. B, V, R and I light curves of SN 2002ap. The open and filled circles indicate the measurements obtained at CBA and PO, respectively. Note the excellent agreement with the data of Gal–Yam et al. (2002; crosses), Riffeser et al. (2002; open squares), Borisov et al. (2002; filled squares) and Yohii et al. (2002; triangles). The solid lines are the least square fits. For clarity, the R and I light curves have been shifted by the amounts noted on the plot.

Table 1: Observations of SN 2002ap

Julian Day	B	V	R	I	Telescope
2452307.26	13.48	12.87	12.93		PO
2452308.65		12.66	12.66	12.88	CBA
2452310.66		12.47	12.45	12.63	CBA
2452314.64		12.38	12.27	12.38	CBA
2452315.65		12.40	12.25	12.33	CBA
2452317.63		12.48	12.31	12.30	CBA
2452318.64		12.56	12.34	12.31	CBA
2452320.65		12.70	12.43	12.39	CBA
2452323.28		12.86			PO
2452323.64		12.87	12.48	12.36	CBA
2452326.22	14.34	13.06	12.69		PO
2452326.66		13.10	12.70	12.50	CBA
2452327.25		13.07	12.76		PO
2452328.22			12.82		PO
2452331.22		13.49	12.86		PO
2452332.24		13.59	13.03		PO
2452335.63		13.84	13.28	12.94	CBA
2452337.64		14.13	13.43	12.99	CBA

Table 2: SN 2002ap light curve properties

Filter	t_0 (J.D.)	m_{max} (mags)	$m(t_0^B)$ (mags)	$\triangle m_{15}$ (mags)	M_{abs} (mags)
B	2452311.8(.5)	13.11(.04)	13.11(.04)	1.31(.06)	–16.7
V	2452314.0(.5)	12.38(.04)	12.43(.04)	0.94(.06)	–17.4
R	2452315.7(.5)	12.28(.04)	12.41(.04)	0.71(.06)	–17.4
I	2452318.6(.5)	12.31(.04)	12.54(.04)	0.63(.06)	–17.3

Figure 1 shows the *BVRI* photometry of SN 2002ap from Table 1 and published data as a function of the Julian date. Using all available photometric data, except some data of Borisov et al. (2002) (see above), we determined the time and the magnitude of maximum light for SN 2002ap in the *B*, *V*, *R* and *I* filters by fitting a fourth-order polynomial to the photometry obtained over 30 days of observation. The results are listed in Table 2, where column (1) gives the time of maximum light, column (2) the magnitude at the time of maximum light, column (3) the magnitude at the time of *B* maximum, column (4) the total magnitude which the light curve decline from maximum to 15 days past maximum, and column (5) the absolute magnitude at maximum brightness. The errors given in this table represent the range of acceptable fits to the data.

The absolute magnitudes of SN 2002ap were computed assuming the distance 8 Mpc (μ=29$^{\rm m}_{.}$5) to M74 from Sharina et al. (1996). Additionally, we correct the absolute magnitudes for Galactic and host galaxy extinctions according to Schlegel et al. (1998) and Klose et al. (2002), respectively. The absolute magnitude at maximum brightness of this object (M_V = –17.4) is comparable to the "hypernova" of type-Ic SN 1997ef (Mazzali et al., 2000), but fainter than SN 1998bw (Galama et al., 1998) by about 2 mag. On the other hand, the shapes of the light curves are similar to those of SN 1998bw. As one can see from Fig. 1 and Table 2, SN 2002ap peaks earlier in the bluer passbands and the peaks of the light curves are wider in the redder passbands. The decline rates of SN 2002ap are also similar to SN 1998bw. Finally, except for the lower peak magnitude, the characteristics of the light curves are similar to those of SN 1998bw. Observations of SN 2002ap at very late stage are needed to reveal the nature of this unique object.

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NEW SU UMa-TYPE DWARF NOVA DM Dra

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DM Dra (=SVS 2426) was originally discovered by Stepanian (1982), who detected an outburst at 15.5 m_{pg} on JD 2443965. The object was reported to be ∼19.5 m_{pg} in quiescence. Stepanian (1982) also obtained a low-resolution spectrum during this outburst, and reported that the spectrum resembled an $O-B$ star. The object was also included in the Second Byurakan Sky Survey as a blue stellar object SBS 1533+599 (Balayan 1997). The object was also detected by the ROSAT X-ray satellite (Verbunt et al. 1997).

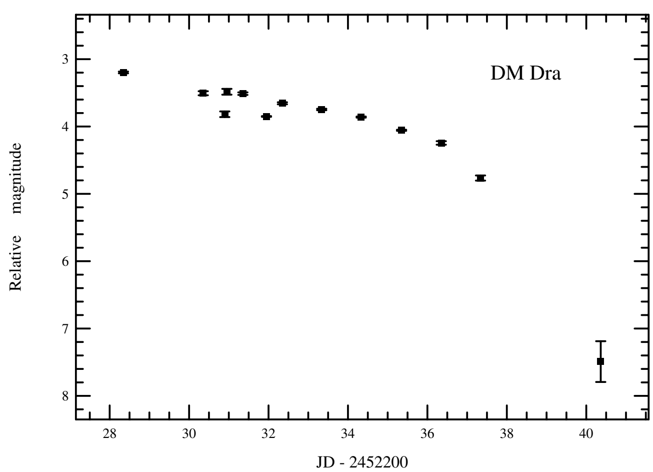

Figure 1. Overall light curve of the 2001 November outburst of DM Dra.

During the survey of faint cataclysmic variables (CVs) at high galactic latitudes (Howell, Szkody 1990), Howell et al. (1990) reported a short CCD time-series photometry of DM Dra in quiescence. Howell et al. (1990) suggested the possible existence of a period of ∼125 min, and a possible fading by 0.4 mag for a duration of 5 min. From this observation, DM Dra has been considered as a candidate SU UMa-type dwarf nova

Table 1. Log of observations

JD start[a]	JD end[a]	mean mag[b]	error[c]	N[d]	exp[e]	Inst.[f]
51844.916	51845.008	4.195	0.021	192	30	1
52228.327	52228.367	3.197	0.013	96	30	2
52230.343	52230.369	3.506	0.030	39	30	2
52230.896	52230.900	3.818	0.042	10	30	3
52230.901	52231.001	3.484	0.043	138	45	3
52231.338	52231.370	3.512	0.019	58	30	2
52231.898	52231.997	3.851	0.005	220	30	3
52232.329	52232.369	3.655	0.015	82	30	2
52233.309	52233.366	3.747	0.011	136	30	2
52234.305	52234.361	3.860	0.008	103	30	2
52235.325	52235.372	4.056	0.008	111	30	2
52236.326	52236.373	4.244	0.026	110	30	2
52237.305	52237.368	4.765	0.038	151	30	2
52240.355	52240.372	7.491	0.303	41	30	2

[a] JD−2400000.
[b] Relative magnitude to GSC 3875.203.
[c] Standard error of nightly average.
[d] Number of frames.
[e] Exposure time (s).
[f] 1: Kyoto (25cm + ST-7), 2: Kyoto (30cm + ST-7E), 3: OUS (30cm + ST-9E)

(see Warner (1995) and Osaki (1996) for recent review of SU UMa-type dwarf novae). The star has therefore been monitored since 1995 by the members of the VSNET Collaboration (`http://www.kusastro.kyoto-u.ac.jp/vsnet/`). Two secure long outbursts (initial positive detections on JD 2451818 and 2452227) and a possible outburst on JD 2451082 have been reported. We conducted CCD time-series observations during the two recent long outbursts.

The observations were mainly done using an unfiltered ST-7E camera attached to the Meade 30-cm Schmidt-Cassegrain telescope at Kyoto University. Some Kyoto observations were made using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The observations at Okayama University of Science (OUS) were done using an unfiltered ST-9E camera attached to a 30-cm Cassegrain telescope. All systems give magnitudes close to R_c. The exposure times were mostly 30 s; the OUS observations on JD 2452230 mostly used 45 s exposure times. The images were dark-subtracted, flat-fielded, and analysed using the Java^{TM}-based PSF photometry package developed by on of the authors (TK). The differential magnitudes of the variable were measured against GSC 3875.203 (Tycho-2 V-magnitude 11.24, $B-V$=0.44), whose constancy during the run was confirmed by comparison with GSC 3875.555 (Tycho-2 V-magnitude 10.75, $B-V$=0.36). The log of observations is summarised in table 1. Barycentric corrections were applied before the period analysis.

Figure 1 shows the overall light curve of the best observed outburst (2001 November). The initial observation started within 1 d of the outburst detection by Timo Kinnunen. The outburst lasted at least 10 d. The overall light curve resembles the plateau portion of an SU UMa-type superoutburst (cf. Warner 1985). The mean rate of decline between JD

2451844 and 2452236 was 0.12 mag d^{-1}, which is a quite typical value for an SU UMa-type superoutburst. The object then experienced a sudden drop by 2.7±0.3 mag in 3.0 d.

Figure 2 shows a representative enlarged light curve of DM Dra during the plateau stage of the outburst. The light curve clearly shows the presence of superhumps with amplitudes of 0.2–0.3 mag. The observation established the SU UMa-type nature of DM Dra, which is consistent with the above findings of the general behavior of the outburst.

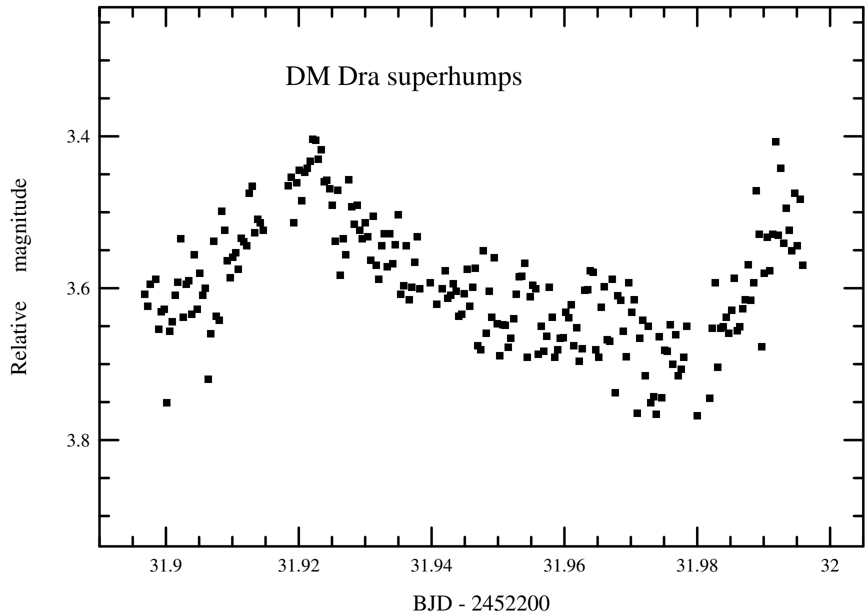

Figure 2. Enlarged light curve of the 2001 November outburst of DM Dra.

In order to more precisely determine the superhump period, we performed period analysis using Phase Dispersion Minimization (Stellingwerf 1978), after removing the systematic trend of decline and a small systematic difference between Kyoto and OUS observations. The θ-diagram and the phase averaged profile of superhumps is shown in Figure 3. The best-determined superhump period is 0.07561±0.00003 d, which is consistent with the period (0.0734±0.0030 d) based on single-night independent superhump observation by T. Vanmunster, (vsnet-alert 6886). The superhump period is far shorter than the possible 125 min periodicity (Howell et al. 1990) in quiescence, making the 125 min unlikely for the orbital period. No eclipse-like fading was observed (Figure 2). The slight difference between superhump profiles between Figure 2 and 3 suggests the presence of time-evolution of superhumps, which is commonly seen in SU UMa-type dwarf novae (e.g. Baba et al. 2000). The evolution was not, however, followed in detail owing to the unavoidable shortness of nightly runs.

The long duration of the 2000 October outburst (at least 11 d; possibly preceded by a precursor brightening) as inferred from the VSNET observation qualifies the superoutburst nature of this outburst.[1] The interval between these two superoutbursts (supercycle) is 393 d, which is a relatively long one among known SU UMa-type dwarf novae (see compilations in Warner 1995 and Nogami et al. 1997).

[1] Although the 2000 Oct. 27 observation covered 0.091 d, the upper limit of superhump-type variation was 0.1 mag. This suggests that superhumps had already decayed (cf. Baba et al. 2000 for a similar example) at the time of the observation.

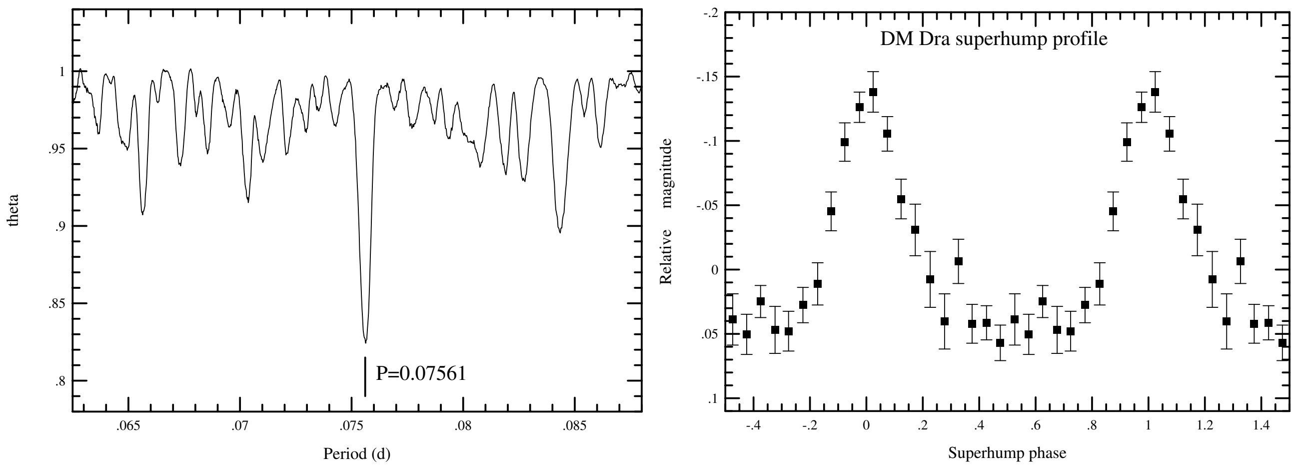

Figure 3. θ-diagram and the phase averaged profile of superhumps.

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THE CONTACT BINARY GSC 3551-1708: LIGHT CURVE ANALYSIS

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Searches for optical transients by the ROTSE project (Akerlof et al., 2000) have discovered, as a byproduct, many new variable stars. The catalogue of these systems (> 1700 in number) and individual light curve data are available (`http://www.umich.edu/~rotse/`).

The ROTSE variable star J192211.80+492831.7 (= GSC 3551-1708) was chosen for study at the Climenhaga Observatory at the University of Victoria because the ROTSE light curve suggested it was a contact binary.

The automatic telescope system at the University of Victoria has been fully described elsewhere (Robb and Greimel, 1999) as have the telescope and equipment of DHK and GWB (Billings, et al., 2001).

Given in Table 1 are the J2000.0 positions and V magnitudes of the observed stars taken from the Guide Star Catalogue (Jenkner, et al., 1990). Also tabulated are the mean differences and standard deviations (σ) both during a night and between nights. From this we can see that the comparison star was constant to approximately 5 millimagnitudes during the time period of our observations. While the standard deviations of GSC 3551-1748 seem large, our data do not prove the variations are intrinsic to the star.

Table 1. Positions and magnitudes

Star	GSC 3551-	RA 19^h	Dec $+49^\circ$	V	ΔR	σ Between	σ During	ΔI	σ Between	σ During
V*	1708	22^m11^s	$28'34''$	11.1	0.177	0.076	var	0.313	0.073	var
C	1771	22^m21^s	$26'06''$	11.2	–	–	–	–	–	–
K1	1977	22^m09^s	$24'15''$	12.3	1.679	0.004	0.011	1.696	0.005	0.013
K2	1835	22^m05^s	$24'28''$	13.1	1.940	0.005	0.014	1.884	0.006	0.012
K3	1575	21^m57^s	$27'47''$	12.9	2.191	0.010	0.022	2.248	0.012	0.017
K4	2084	22^m03^s	$25'55''$	14.2	2.653	0.010	0.025	2.402	0.010	0.022
K5	1468	22^m13^s	$27'30''$	14.1	2.645	0.014	0.023	2.474	0.007	0.022
K6	1748	22^m34^s	$27'16''$	13.9	2.630	0.036	0.040	2.533	0.033	0.031

Over the period 2001 October 4-28, light curves in R_c and I_c were acquired by RMR which contained one distinct time of minimum (ToM) in R. In addition, DHK and GWB obtained ToM in V and unfiltered light, respectively. Using Period98 (Sperl, 1998) we searched our R data for periodicity and found the period 0.59208(6) days, in good agreement with the ROTSE period of 0.59205(5) days (where the figures in brackets are the uncertainties, in units of the last digit).

These periods and uncertainties allow us to include the ROTSE ToMs with our own to further refine the period. All the available times of minimum are listed in Table 2 together with the $O-C$ values from the best-fit ephemeris:

$$\begin{array}{rl}\text{Min. I} = \text{HJD } 2452186.90143 + 0\overset{\text{d}}{.}5921376 \times E. \\ \pm 0.00010 \pm 0.0000005\end{array}$$

with all ToMs weighted equally.

Table 2. Observed minima of GSC 3551.1708

Source	Type	HJD 2400000 +	Error (Days)	Epoch	$O-C$
ROTSE	I	51257.8370	na	-1569	-0.0006
ROTSE	I	51286.8520	na	-1520	-0.0003
ROTSE	I	51311.7230	na	-1478	0.0009
RR	I	52186.9007	0.0002	0	-0.0007
DHK	II	52189.5671	0.0001	4.5	0.0011
GWB	II	52307.9932	0.0002	204.5	-0.0004

The R (455 points) and I (272 points) light data are plotted in Figure 1. The data were analyzed by the Wilson-Devinney (WD) light curve analysis program (Wilson and Devinney, 1971; Wilson, 1990) on a computer running Windows, using a Windows interface program, WDWint.exe[1], written by RHN.

The general appearance of the light curve suggested a contact binary; hence Mode 3, synchronous rotation ($F_1 = F_2 = 1.0$), and a circular orbit (e=0.0) were used. Since the maximum at phase 0.75 was some two percent dimmer than the maximum at phase 0.25, a spot solution was sought from the start. The Tycho catalogue (ESA, 1997) gave a colour index of $B-V = 0.38$ magnitudes and, assuming that interstellar reddening is negligible, this gives a spectral type of approximately F4 (Allen, 1973) and accordingly, a temperature $T_1 = 6820$ K was used (Flower 1996). Stellar masses and radii, taken to be main sequence values for an F4 star (Allen 1973), were used to calculate log g. Limb darkening values were found from van Hamme's tables (van Hamme, 1993), interpolated by Dirk Terrell's program (`http://www.boulder.swri.edu/~terrell/ld/`). The square root form for the limb darkening law was selected because of the assertion (van Hamme, 1993) that this is preferred over the logarithmic law for red and infrared wavelengths; it also gave lower residuals. Central wavelengths were assumed to be 6530 and 7890Å for R and I, respectively (Bessell, 1979). The light data were all assigned equal weights of 1.0.

Light curve synthesis (with a grid size integer of $N_1 = N_2 = 30$) was used to obtain a reasonable fit; the parameters adjusted were i, T_2, Ω_1, q, L_1 as well as the location, size and relative temperature of the spot(s). After that, differential corrections (with the same grid size) was applied on both R and I data simultaneously, using the method of multiple subsets (Wilson and Bierman, 1976); subsets used were (i, T_2, q), (i, T_2, Ω_1), (i, Ω_1, L_1), (Spot Longitude, Spot Radius, i), and (Spot Longitude, Spot Temperature Factor, i).

[1]This program speeds the WD modelling process greatly; it writes the input files for light curve synthesis (LC) and differential corrections (DC), runs the compiled WD code from the interface, and automatically displays output data in convenient tables and graphs. It is available to all who wish it at RHN's e-mail address above.

Because a star of spectral type F4 can be radiative at the surface, initial runs were made using the radiative mode; however this required two spots on star 2 and never reached a satisfactory solution. Once convective mode was selected, it was not necessary to cycle more than once or twice through the subsets; convergence was achieved in about a dozen runs. These initial runs assumed the stars radiated as black bodies, but later runs used the atmosphere option of WD which uses the Carbon and Gingerich atmospheres (Carbon and Gingerich, 1969).

A series of runs was attempted with a spot on star 1, but convergence could not be attained. Two spots on star 1 yielded some success, but this avenue was not followed nor was a solution involving a hot spot. A single spot on star 2 worked well.

Solutions obtained using the R and I light curves are displayed in Table 3. Note that the quoted errors are formal errors indicated by the WD software and the actual uncertainties may be larger. Synthetic light curves, produced by LC, are shown in Figure 1 (Upper: R band; lower: I band shifted down 0.2).

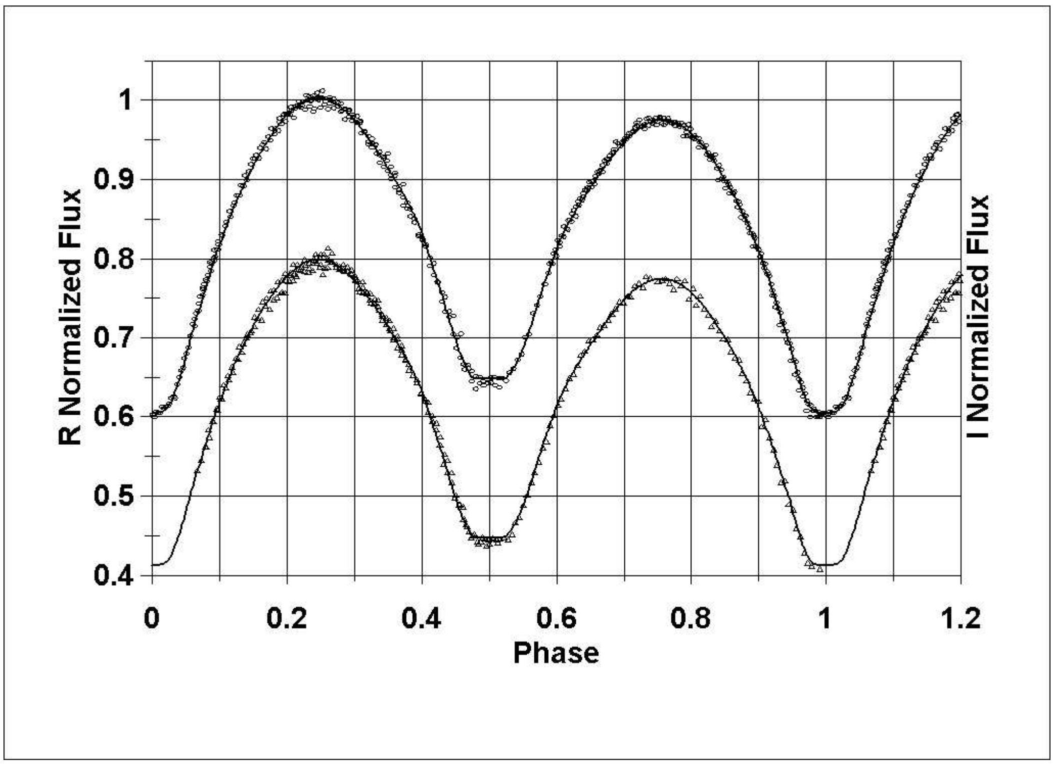

Figure 1. Phased R and I light data.

Table 3. Solution parameters

Quantity	Result	Error	Quantity	Result	Error
e	0.00	assumed	$\Omega_1 = \Omega_2$	2.390	0.004
$F_1 = F_2$	1.00	assumed	$q = M_2/M_1$	0.306	0.002
$g_1 = g_2$	0.32	assumed	$L_1/(L_1 + L_2)(R)$	0.753	0.001
$A_1 = A_2$	0.50	assumed	$L_1/(L_1 + L_2)(I)$	0.753	0.001
$x_1 = x_2$ (bol)	0.109	assumed	Spot Lat°	90	assumed
$y_1 = y_2$ (bol)	0.615	assumed	Spot Long°	280	11
$x_1 = x_2(R)$	-0.004	assumed	Spot Radius°	22	4
$y_1 = y_2(R)$	0.724	assumed	Sp Temp factor	0.71	0.07
$x_1 = x_2(I)$	-0.056	assumed	r_1 (pole)	0.473	0.001
$y_1 = y_2(I)$	0.688	assumed	r_1 (side)	0.514	0.002
ϕ	0.0007	0.0003	r_1 (back)	0.546	0.002
$i°$	81.8	0.2	r_2 (pole)	0.283	0.002
T_1 (K)	6820	assumed	r_2 (side)	0.298	0.003
T_2 (K)	6615	20	r_2 (back)	0.351	0.006

Inspection of the light curves reveals a flat-bottom at secondary minimum, indicating that this is an A-type W UMa system (Duerbeck, 1996), consistent with the assumed spectral type F4V. This system is reminiscent of V728 Herculis (Nelson, et al., 1995), but it has a lower mass ratio and different inclination. V728 Her is undergoing a steady period increase (Nelson, 1999), which means that mass is being transferred from star 2 to star 1 (thereby lowering the mass ratio). It would be prudent to monitor the period behavior of this system to see if it will have the same fate as V728 Her.

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HAS AY Dra INCREASED AMPLITUDE?

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The variability of AY Dra (= BV 338 = GSC 03872 01194 = IRAS 15374+5711; $\alpha = 15^{\rm h}38^{\rm m}39.34^{\rm s}$, $\delta = 57°01'33.8''$ [J2000]) was first noted by Strohmeier and Knigge (1960a). They determined variability between 10.6 and 12.6 mag on their photographic plates and a preliminary long period variable classification. Strohmeier and Knigge (1960b) observed three times of maxima and derived a pulsation period of 283.5 days. Nikulina (1961) published one time of maximum light with the remark that the star is probably of Mira type. Huth and Wittman (1968) searched photographic plates and determined 19 new times of maximum light and a new period of 262.5 days. Tsessevich and Makarenko (1983) mention that about 1400 photoelectric measurements of AY Dra are deposited in the archive of Odessa Astrophysical Observatory. However, we have been informed by I. L. Andronov that these are actually measurements of the bright eclipsing binary AI Dra. Stephenson (1985) determined an approximate M7 spectral type for AY Dra. AY Dra entered the GCVS (Kholopov et al., 1985) as a SRa type variable star. Guglielmo et al. (1997) made JHK observations of AY Dra showing that the star is oxygen rich. No observations of AY Dra can be found in the databases of amateur visual observations. Thus, the star was selected as a target for MEDUZA[†] observers.

We carried out visual and CCD observations of AY Dra. For the calibration of the field stars, Henden used the USNO Flagstaff Station 1.0 m telescope equipped with a SITe/Tektronix 1024 × 1024 CCD to observe the field in the standard Johnson-Cousins $BV(RI)_c$ passbands on four photometric nights, using Landolt standards to calibrate the field. Astrometry is based on USNO-A 2.0 and has less than 100mas internal error. Field photometry based on four nights is available through IBVS website as 5286-t2.txt. Sobotka and Pejcha used the 0.4 m Newtonian telescope of Nicholas Copernicus Observatory and Planetarium in Brno, equipped with an SBIG ST-7 CCD camera and VRI

[†] http://www.meduza.info

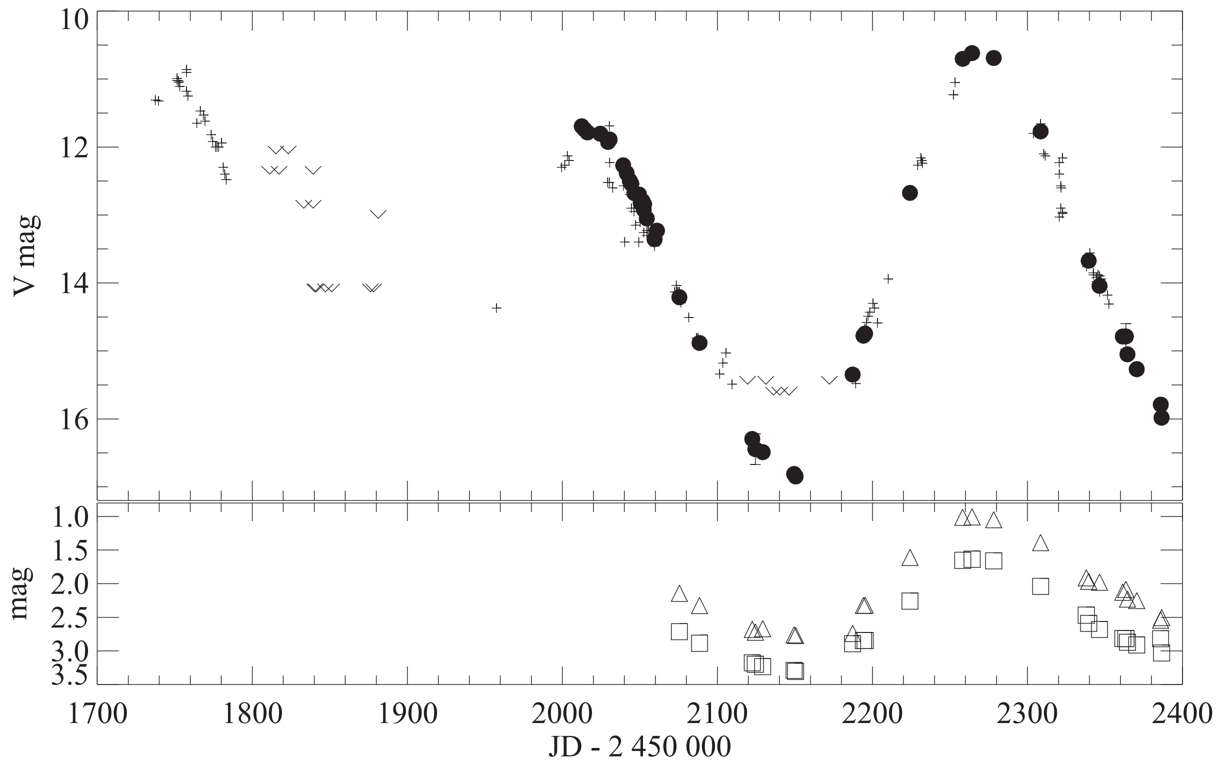

Figure 1. Light curves of AY Dra. Upper panel: plus signs are visual observations, filled circles are CCD V band measurements with corresponding error bars. "V" shaped symbols are upper limits of visual observers. Lower panel: triangles are $V-R$ values and squares are $R-I$ values (shifted by +0.2 mag for plot clarity).

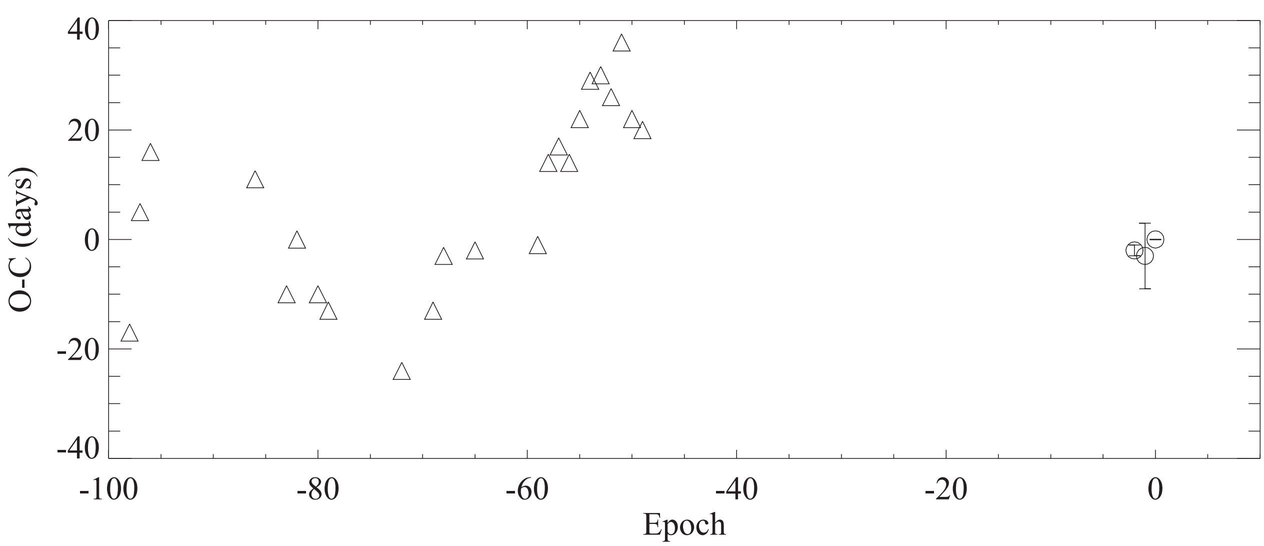

Figure 2. $O-C$ diagram of maxima timings of AY Dra based on data from Table 1 and ephemerides determined in this paper. Triangles are photographic observations and circles with error bars maxima from this paper.

filters. Frames (typically two to six in each band per night) were processed using MUNIDOS 2.2 (Hroch, Novák and Král, 2001). Observations were transformed to the standard Johnson-Cousins photometric system. Systematic zero-point shifts should be below 0.2 mag. Šmelcer employed the 0.28 m Schmidt-Cassegrain telescope of the Valašské Meziříčí Observatory with an SBIG ST-7 camera and V filter. CCDOPS software bundled with SBIG cameras was used for photometry. Dubovský, Brát and Pejcha made visual observations using 30, 25 and 25 cm Dobsonian telescopes, respectively. A few additional estimates were made by other MEDUZA members. The magnitudes of the comparison stars were based on magnitudes from TYC, TYC-2, GSC and field photometry from this paper; the finding chart can be found at the MEDUZA web page. As visual observations agree well with simultaneously taken CCD measurements, we find their precision adequate. Visual observations are available through the MEDUZA web page and CCD observations from the authors upon request.

Figure 1 shows the CCD V band and visual light curve as well as $V-R$ and $R-I$ color curves. For clarity, weighted averages of CCD observations made on the same night with the same filter and by one observer were plotted. Magnitude errors served as weights.

In Table 1 we present times of maximum light collected from literature and determined from our observations using the Kwee and von Woerden (1956) method as implemented in AVE (Barbera 2000). To create a denser dataset, visual observations and CCD V band timings were both used. The timing of the last maximum was determined separately in each passband and the final value in Table 1 is weighted average from the three passbands as no obvious difference is seen in times of maximum light determined in different filters. Linear regression using all times of maximum light yields the following ephemeris:

$$\begin{array}{l} \text{Max.} = \text{JD } 2452275.0 + 261.94 \times E. \\ \qquad\qquad\qquad\quad \pm 0.5 \qquad\quad \pm 0.08 \end{array}$$

Our best observed maximum was chosen as the fundamental epoch. We assigned double weights to maxima determined in this paper. An $O-C$ diagram based on the ephemeris shown above and data from Table 1 is presented in Figure 2.

Our light curve amplitudes in the VRI filters are 6.0, 3.9 and 2.4 mag, respectively. Our amplitude in the V band is about three times higher than that of Strohmeier and Knigge (1960a). Comparison between currently known V band amplitudes for other stars with amplitudes given in Strohmeier and Knigge (1960a) do not show any difference higher than 0.2 mag. This means that, the amplitude of AY Dra has increased by a factor of three, leaving the maximum brightness roughly unchanged. Such a phenomenon has not been observed among classical Mira variables, but some semiregulars seem to exhibit such amplitude modulation. Kiss et al. (2000) attributed variations of amplitude with constant maximum brightness to a combination of nonradial pulsations and rotation, which seems to be quite unlikely for Mira variables. $B-V$ values of AY Dra near minimum light do not indicate presence of any hot companion. We would like to invite astronomers to look through archives of photographic plates to confirm or disprove this possible amplitude variation of AY Dra.

Acknowledgements: We acknowledge overall support and the use of the telescope with CCD camera of the Nicholas Copernicus Observatory and Planetarium. We would like to thank L. Král and M. Brož for software support and Dr. Mikulášek for careful review of the manuscript.

This work has made use of the SIMBAD database, operated at CDS, Strasbourg, France. The NASA ADS Abstract Service was used to access data and references.

Table 1: Maxima timings of AY Dra

Geo. JD	Error	Filter	Epoch	$O-C$	Observer	Source	Remark
2426588		pg	−98	−17	Strohmeier&Knigge	BV 11,6	
2426872		pg	−97	−5	Strohmeier&Knigge	BV 11,6	
2427145		pg	−96	16	Strohmeier&Knigge	BV 11,6	
2429759		pg	−86	11	Huth	MVS 4,176	uncertain
2430524		pg	−83	−10	Huth	MVS 4,176	
2430796		pg	−82	−0	Huth	MVS 4,176	
2431310		pg	−80	−10	Huth	MVS 4,176	uncertain
2431569		pg	−79	−13	Huth	MVS 4,176	
2433391		pg	−72	−24	Huth	MVS 4,176	
2434188		pg	−69	−13	Nikulina	AT 227,17	
2434460		pg	−68	−3	Huth	MVS 4,176	
2435247		pg	−65	−2	Huth	MVS 4,176	
2436820		pg	−59	−1	Wittman	MVS 4,176	
2437097		pg	−58	14	Wittman	MVS 4,176	
2437361		pg	−57	17	Wittman	MVS 4,176	
2437620		pg	−56	14	Wittman	MVS 4,176	
2437890		pg	−55	22	Wittman	MVS 4,176	
2438159		pg	−54	29	Wittman	MVS 4,176	
2438422		pg	−53	30	Wittman	MVS 4,176	
2438680		pg	−52	26	Wittman	MVS 4,176	
2438952		pg	−51	36	Wittman	MVS 4,176	
2439200		pg	−50	22	Wittman	MVS 4,176	
2439460		pg	−49	20	Wittman	MVS 4,176	
2451749	1	V+vis	−2	−2	this paper	this paper	
2452010	6	V+vis	−1	−3	this paper	this paper	
2452275	0.5	V+R+I+vis	0	0.0	this paper	this paper	basic maximum

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CCD TIMES OF MINIMA OF FAINT ECLIPSING BINARIES IN 2000

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Observatory and telescope:
16″ Newtonian telescope (f/1750 mm) at N. Copernicus Observatory and Planetarium in Brno

Detector:	CCD camera SBIG ST-7, Peltier cooling, KAF1600 chip, $9' \times 13'$ FOV, 255×382 pixels.

Method of data reduction:
Reduction of the CCD frames was made with a software package Munidos[1].

Method of minimum determination:
The minima times were computed using several procedures written by A. Gaspani (1995) based on artificial neural networks.

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
TT And	EA/SD:	23 13 23	+46 08 52	3623.2539 [2]	34237.413	2.765142	1
FL And	EA/SD	01 08 01	+36 53 22	2290.0121	38238.465	0.905644	1
KN And	E	02 36 09	+38 09 22	2832.2197	28593.2862	2.2621777	2
EX Aqr	EB	21 15 15	+02 28 45	0532.0746	37882.531	0.8893836	1
V616 Aql	EA:/SD:	19 31 36	+10 49 06	1059.1942	28332.448	1.69058	1
V770 Aql	EA/SD:	20 03 09	+09 50 15	1076.0483	28746.408	1.59289	1
V784 Aql	EW/KW	20 07 07	+13 29 59	1084.1623	52141.4624	0.587694	3
V1075 Aql	EA/SD:	20 00 17	+15 34 11	1617.2360	27635.457	0.880981	1
V1299 Aql	EA/SD:	20 05 03	+14 58 19	0975.17815756	39237.559	1.791745	1
MO Aur	E	05 45 21	+31 54 31	2409.0241	49004.449	5.2666871	4
TY Boo	EW/KW	15 00 47	+35 07 54	2568.0991	34480.425	0.3171477	1
AC Boo	EW/KW	14 56 28	+46 21 44	3474.0835	25776.431	0.35242943	1
AR Boo	EW/KW:	13 48 10	+24 55 28	0199.0233	50182.4799	0.3448733	5
CK Boo	EW/KW	14 35 04	+09 06 54	0910.0654	47982.43008	0.355157901	3
SW Cnc	EA/SD:	09 08 59	+09 35 41	0812.0192	30495.651	1.799211	1
WX Cnc	EA/DM:	08 46 51	+32 51 06	2487.0106	25620.377	1.2245888	1
RV CVn	EW/SD:	13 40 18	+28 18 22	2004.0793	44375.4430	0.2695671	1
TU CMi	EW/KW	07 37 06	+07 50 47	0765.1531	25245.604	0.43344	1
AG CMi	EA/SD	07 08 36	+06 14 26	0175.3085	34698.677	1.6645438	1
AL Cas	EW	02 13 50	+70 09 01	4315.0452	44490.366	0.50055583	1
MM Cas	EA/SD	00 54 31	+54 26 16	3672.0189	35401.483	1.15847	1

[1] Hroch, F., Novák, R., 1997, MUNIDOS, `http://munipack.astronomy.cz/`

[2] The names of the comparison stars are from the GSC and USNO A2.0 respectively

Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
MT Cas	EW/KW	00 14 45	+54 39 41	3657.1980 [2]	44941.5925	0.31387768	1
V360 Cas	EA/SD	23 34 43	+55 54 36	4004.0715	31346.424	1.500590	1
V361 Cas	EA/KE:	23 41 58	+56 08 39	4004.1027	30319.344	1.228985	1
V702 Cas	EA/SD	23 00 37	+54 39 44	3989.1874	40150.474	2.478783	6
TV Cep	EA/SD	22 09 54	+63 07 05	4267.1774	21366.623	3.857082	1
IM Cep	EB	23 13 09	+62 41 56	4283.0363	29931.265	0.921589	1
LP Cep	EA/SD	21 19 50	+60 42 28	4248.1072	30517.465	0.6930642	1
CN Com	EB	12 19 38	+16 31 21	1445.1516	37668.520	0.73544	1
DD Com	EW/KW	12 28 46	+21 43 25	1447.1638	37779.410	0.2692061	1
EQ Com	EB	12 58 52	+18 00 49	1453.0621	37705.584	0.361867	1
W Crv	EB/KW:	12 07 36	−13 09 30	5525.0351	39647.766	0.38808083	1
QS Cyg	E/KE	19 57 40	+38 48 21	3137.1978	23730.358	1.044000	1
QT Cyg	EA/SD	19 58 07	+38 49 29	3137.1978	33408.553	3.33558992	1
QU Cyg	E	19 58 28	+38 13 30	3137.3455	24026.509	0.3469103	1
QX Cyg	E/DW	19 58 35	+38 14 36	1275.12938182	23352.335	0.89961	1
V454 Cyg	EB/SD	20 15 57	+37 30 29	2684.0631	28725.469	2.3168937	1
V505 Cyg	EB	20 29 29	+32 47 47	2689.1334	50320.361	0.6676618	7
V526 Cyg	EA/SD:	21 10 18	+45 56 11	3588.2806	33762.414	1.2334603	1
V704 Cyg	EW	21 28 12	+45 37 38	3590.0282	37939.409	0.570704	1
V706 Cyg	EB	21 35 55	+40 50 34	3187.1613	40116.429	0.46625592	1
V711 Cyg	EA/SD	21 51 16	+48 02 48	1350.15107073	32802.447	0.826757	1
V787 Cyg	EA	20 16 16	+47 59 49	3576.0603	16457.424	1.5285151	1
V824 Cyg	EB	20 02 31	+36 13 57	2682.2736	32806.1065	0.644194765	1
V880 Cyg	EA/KE:	19 31 27	+33 39 20	1200.11885216	33857.404	1.0600316	1
V906 Cyg	EW/KW	19 34 57	+34 38 40	1200.12133312	31962.5859	0.365166713	1
V907 Cyg	EW/KW	19 35 30	+29 45 48	2150.1562	39029.450	0.426056	1
V931 Cyg	EW/KW	19 39 14	+29 46 09	2150.1262	34134.4975	0.34149157	1
V947 Cyg	EW/KW	19 42 15	+31 35 39	2656.1237	35044.474	0.42924466	1
V1019 Cyg	EA/SD	19 58 38	+30 23 24	2670.1411	33542.334	2.2793125	1
V1414 Cyg	LB	22 01 20	+47 36 11	3609.2600	29112.380	0.703126	1
V1580 Cyg	M	19 44 10	+45 27 29	1350.10973430	42653.610	1.811443	1
V1787 Cyg	EA	20 37 47	+55 16 29	3954.0991	45449.6	0.7396	8
V2240 Cyg	EW	20 15 56	+37 27 16	2684.0631	51652.5305	0.40419022	9
FH Del	EA/SD:	20 28 12	+19 26 60	1050.17756220	29791.410	0.678036	1
RZ Dra	EB/SD:	18 23 06	+58 54 15	3916.0868	44177.5555	0.5508738	1
TW Dra	EA/SD	15 33 51	+63 54 24	4184.0387	44136.295	2.8068470	1
AK Dra	EA	18 16 44	+53 14 47	3904.1131	26828.530	2.218237	1
AR Dra	EA/SD:	12 16 37	+64 51 26	4158.0442	42868.9114	0.6758375	1
VV Eri	EA/SD:	03 21 24	−10 17 04	5298.1053	27342.522	1.557586	1
AV Gem	EA/SD	06 42 01	+13 24 45	0758.1933	27832.6099	1.2216548	1
BT Gem	EA/SD:	06 11 42	+23 20 16	1877.1565	28453.64	1.2369358	1
CW Gem	EA/SD	06 40 06	+21 52 12	1341.0981	28126.45	1.678148	1
EL Gem	EA/KE:	06 29 05	+20 48 60	1340.2169	28192.26	1.4283286	1
FT Gem	EW	06 57 20	+13 40 58	0760.0050	30328.723	0.587612	1
KQ Gem	EB/KW	06 43 50	+15 53 56	1330.1192	29231.515	0.4079925	1
KV Gem	RRC:	06 47 12	+15 43 17	1330.0101	52234.6975	0.358519	3
V342 Her	EB/SD:	18 24 06	+25 04 41	1125.09447033	35693.440	0.851730	1
V719 Her	RRC:	17 09 52	+42 56 07	3084.0570	41598.278	0.335870	1
V789 Her	EW/KW	17 05 43	+42 31 02	3080.1094	51679.4219	0.3200554	3
GN Hya	EA	08 48 12	+02 05 53	0216.1653	25646.517	2.2495444	1
EL Lac	EA/SD	22 08 52	+42 16 21	3206.2024	25502.578	2.806792	1
GH Lac	EA	22 39 35	+47 14 40	3624.0346	25423.506	0.532645	1
HX Lac	EW	22 06 09	+49 32 09	3613.2498	25243.115	0.5274659	1
KO Lac	EA/SD	22 14 31	+53 29 02	3982.2126	33206.445	1.0260728	1
LU Lac	EW/KW	22 21 42	+51 22 04	3619.3885	33513.5649	0.29880135	1
NR Lac	EB	22 29 21	+49 41 59	3615.0868	33873.638	0.6048038	1
RW Leo	EA/SD	10 39 40	+08 59 39	0839.0530	43324.73087	1.6825565	1

[2] The names of the comparison stars are from the GSC and USNO A2.0 respectively

Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
BL Leo	EW/KW	11 45 33	+24 46 20	1985.0975 [2]	44648.756	0.2819306	1
BW Leo	EW/KW	11 32 09	+17 19 26	1438.1475	38111.429	0.337221	1
Z Lep	E	05 10 09	−14 52 19	5342.0269	27424.311	0.993715	1
AH Lyn	EA	08 42 18	+37 11 08	2490.0592	37647.022	1.016412	10
DT Lyr	EA/SD:	19 03 23	+29 53 18	2134.0166	25493.355	0.787904	1
KT Lyr	EB	18 32 48	+33 01 19	2628.0663	29752.38	0.581550	1
MN Lyr	EB/KE	18 42 48	+35 05 02	2645.0811	29373.57	0.544076	1
PY Lyr	EW/KW	19 20 26	+28 56 47	2136.1185	51663.5696	0.3857770	3
V361 Lyr	E	19 02 31	+46 58 27	3545.2244	44523.307	0.309616	1
V412 Lyr	EA/KE	19 06 50	+29 16 44	2134.1428	38260.393	0.931469	1
V417 Lyr	EW/KW	19 08 40	+30 43 22	2640.0718	39376.33	0.300660	1
V429 Lyr	EA/SD	19 13 37	+34 29 19	1200.10838787	39330.455	1.067594	1
V431 Lyr	EW/KW	19 14 00	+33 35 32	1200.10864421	39998.468	0.446367	1
V563 Lyr	EW	18 45 07	+40 11 12	3122.2865	50700.3444	0.577639	11
VX Mon	EA/SD	06 31 00	+09 18 21	0733.2665	25300.34	1.62967	1
BH Mon	EA	06 56 37	+09 19 31	0748.0557	26297.576	2.324668	1
CP Mon	EA/SD	07 00 11	+04 09 45	0170.1838	25981.575	1.8836801	1
GU Mon	EW	06 44 47	+00 13 15	0147.1646	30345.347	0.89668149	1
V396 Mon	EW/KW	06 38 37	+03 36 18	0151.0295	34769.4175	0.39634498	1
V524 Mon	EW/KW	06 59 01	+02 12 56	0153.0998	34446.4420	0.28361714	1
V532 Mon	EW:/KW:	07 04 30	−00 21 03	4814.1217	34769.3467	0.46698470	1
V981 Oph	EA/SD	17 48 50	+11 24 36	1002.0623	36069.259	1.4285133	1
CQ Ori	EA	06 23 34	+13 56 41	0744.1012	38455.21	2.74016	1
DZ Ori	EA/SD:	06 09 29	+15 39 19	1314.1355	25243.53	1.83614	1
EG Ori	EA/SD	06 11 06	+16 19 12	1314.0765	25245.41	1.163166	1
GU Ori	EA	06 10 05	+12 49 22	0738.0513	43069.8875	0.47068240	2
OS Ori	EA/SD	05 36 20	+08 49 55	0701.0379	45386.349	2.383525	1
CH Per	EA/SD	02 04 36	+53 53 10	3685.1951	43755.511	1.314649	1
EQ Per	EA/SD	02 56 19	+52 11 05	1350.02871659	29187.37	1.48579	1
FW Per	EA/SD:	04 27 43	+52 28 53	3732.0889	28429.375	0.7912215	1
II Per	EB/KW	04 29 37	+44 25 32	2891.2911	30257.550	0.479854	1
PS Per	EA/SD:	02 39 33	+45 38 12	3296.1840	24527.250	0.7021775	1
V434 Per	EW/KE:	03 21 41	+40 17 38	2865.1814	38709.473	0.536098	1
V Sge	E+NL	20 20 15	+21 06 08	1643.1984	37889.9154	0.514195	1
AP Tau	EA	04 54 45	+26 55 24	1840.0511	39414.438	0.9719728	1
V Tri	EB/SD	01 31 47	+30 21 49	2293.1021	24474.305	0.5852057	1
RS Tri	EA/DM	01 34 49	+29 35 21	1755.1433	37940.490	1.9089234	1
RV Tri	EA/SD	02 13 18	+37 01 01	2321.1715	46033.308	0.75366648	1
ST Tri	EB/SD:	02 41 34	+35 43 30	2336.0603	39025.468	0.4790536	1
23360281 Tri	EW	02 41 41	+35 42 54	2336.0603	51550.3118	0.3739783	3
AX Vir	EB/KE	13 27 45	+03 52 28	0303.0397	27570.444	0.7025262	1
BH Vir	EA/DW/RS:	13 58 25	−01 39 40	4968.0476	43230.609	0.81687161	1
RR Vul	EA	20 54 48	+27 55 11	2179.0613	35035.437	5.05070	1
FF Vul	E/KW	20 23 10	+25 43 42	2160.0239	51796.495	0.44497799	10

Source(s) of the ephemeris:

1: Kholopov et al., 1985; 2: Kreiner, J.M. et al., 2000; 3: Zejda, M., 2002; 4: Williams, D. B., 1996; 5: Wolf, M., Borovička, J., Šarounová, L., Šafář, J., Šafářová, E., 1998; 6: Häussler, K., 1990; 7: Danielkiewicz-Krosniak, E., 2001; 8: Locher, K., 1983; 9: this paper 10: Kinman, T.D., Mahaffey, C.T., Wirtanen, C.A., 1982; 11: Beltraminelli, N., Dalmazio, D., Remis, J., Manna, A., 1999;

[2] The names of the comparison stars are from the GSC and USNO A2.0 respectively

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
TT And	51848.5437	0.0019	I	-	−0.0587	normal min.
FL And	51848.5405	0.0067	I	-	0.0575	normal min.
	51799.6383	0.0030	I	-	0.0600	normal min.
KN And	51848.4852	0.0028	I	-	0.0122	
EX Aqr	51777.4040	0.0097	I	-	0.0330	
V616 Aql	51799.3961	0.0012	I	-	0.0071	
V770 Aql	51778.3205	0.0033	I	-	0.3160	normal min.
V784 Aql	51679.5399	0.0029	I	-	0.0050	normal min.
	51776.5081	0.0023	I	-	0.0037	
	51799.4286	0.0020	I	-	0.0041	
V1075 Aql	51781.3608	0.0073	I	-	−0.0234	
V1299 Aql	51799.4439	0.0021	I	-	−0.0393	
MO Aur	51569.3341	0.0030	I	-	0.0085	normal min.
TY Boo	51679.4228	0.0032	I	-	0.0780	normal min.
AC Boo	51635.5901	0.0032	I	-	0.0021	
	51626.4275	0.0015	I	-	0.0027	
	51694.4485	0.0048	I	-	0.0048	normal min.
AR Boo	51580.5980	0.0033	I	-	0.0017	normal min.
	51626.4677	0.0015	I	-	0.0033	
CK Boo	51657.4190	0.0067	II	V	−0.0075	normal min.
	51772.3100	0.0049	I	V	−0.0100	normal min.
SW Cnc	51580.5470	0.0016	I	-	−0.0577	
WX Cnc	51580.4459	0.0038	I	-	0.0109	normal min.
RV CVn	51626.5506	0.0030	I	-	0.0222	normal min.
TU CMi	51876.5038	0.0049	I	-	−0.0872	
AG CMi	51580.4073	0.0024	I	-	−0.0729	normal min.
AL Cas	51772.4435	0.0015	I	-	−0.0087	
	51771.4436	0.0056	I	-	−0.0075	normal min.
MM Cas	51776.5201	0.0024	I	-	0.0637	
	51841.3964	0.0021	I	-	0.0656	
MT Cas	51550.2943	0.0030	I	-	0.0072	
V360 Cas	51550.2690	0.0015	I	-	−0.0988	
	51841.3881	0.0020	I	-	−0.0941	normal min.
V361 Cas	51778.4792	0.0090	I	-	−0.1719	normal min.
V702 Cas	51778.4784	0.0054	I	-	0.0333	normal min.
TV Cep	51841.4931	0.0052	I	-	0.0652	
IM Cep	51848.3939	0.0027	I	-	−0.1007	normal min.
LP Cep	51841.6151	0.0017	I	-	−0.0492	
CN Com	51657.3741	0.0018	I	-	0.0499	
DD Com	51672.3839	0.0045	I	-	0.0547	normal min.
EQ Com	51657.3984	0.0017	I	-	0.0322	
W Crv	51576.6059	0.0035	I	-	0.0113	normal min.
QS Cyg	51777.3971	0.0064	I	-	−0.0209	
QT Cyg	51777.4874	0.0156	I	-	−0.1593	
QU Cyg	51626.6168	0.0010	I	-	−0.0757	
	51777.3512	0.0081	I	-	0.0997	normal min.
	51776.4819	0.0049	I	-	−0.0758	
	51777.5212	0.0028	I	-	−0.0772	
QX Cyg	51697.4865	0.0023	I	-	0.2396	
	51777.5490	0.0070	I	-	0.2368	normal min.
	51776.6348	0.0075	I	-	0.2222	normal min.
V454 Cyg	51697.4653	0.0020	I	-	−0.0047	
	51799.4096	0.0019	I	-	−0.0038	
V505 Cyg	51697.4104	0.0016	I	-	−0.0031	normal min.
V526 Cyg	51778.3956	0.0083	I	-	0.0605	
V704 Cyg	51626.6336	0.0027	I	-	0.0306	normal min.
	51799.5586	0.0024	I	-	0.0323	

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
V706 Cyg	51776.5246	0.0028	I	-	−0.0324	
	51778.3897	0.0023	I	-	−0.0324	
	51721.5085	0.0015	I	-	−0.0303	
	51841.3359	0.0046	I	-	−0.0307	
V711 Cyg	51694.4125	0.0022	I	-	−0.2587	
	51626.6167	0.0067	I	-	−0.2604	normal min.
	51799.4063	0.0018	I	-	−0.2630	
	51814.2834	0.0034	I	-	−0.2676	normal min.
V787 Cyg	51781.4110	0.0015	I	-	0.0030	
V824 Cyg	51841.4358	0.0054	I	-	0.0182	normal min.
V880 Cyg	51799.4968	0.0064	I	-	−0.0021	
V906 Cyg	51635.6309	0.0032	I	-	0.0535	normal min.
V907 Cyg	51635.6427	0.0081	I	-	0.0478	normal min.
V931 Cyg	51635.6161	0.0022	I	-	0.0171	normal min.
V947 Cyg	51694.4158	0.0060	I	-	−0.0293	normal min.
V1019 Cyg	51781.4849	0.0094	I	-	0.0923	normal min.
V1414 Cyg	51778.3919	0.0020	I	-	0.0422	type err.
	51799.4907	0.0048	I	-	0.0472	
V1580 Cyg	51799.5206	0.0102	I	-	−0.0651	type err.
V1787 Cyg	51777.5538	0.0074	I	-	−0.0638	normal min.
V2240 Cyg	51778.4336	0.0120	II	-	−0.0022	
	51799.4447	0.0019	II	-	−0.0089	
FH Del	51697.4503	0.0105	I	-	0.0532	normal min;DH
RZ Dra	51777.4460	0.0029	I	-	0.0356	
TW Dra	51675.5165	0.0024	I	V	0.0305	
AK Dra	51679.5661	0.0075	I	R	0.1270	normal min.
AR Dra	51697.3809	0.0087	I	-	0.0042	normal min.
VV Eri	51569.3073	0.0019	I	-	0.0927	
AV Gem	51608.4327	0.0036	I	-	−0.0229	
BT Gem	51626.3896	0.0018	I	-	−0.0057	
	51841.6168	0.0039	I	-	−0.0053	normal min.
CW Gem	51850.4584	0.0024	I	-	0.0301	normal min.
EL Gem	51876.6010	0.0091	I	-	−0.2038	normal min.
FT Gem	51608.4915	0.0102	I	-	−0.0125	normal min.
KQ Gem	51569.4548	0.0020	I	-	−0.0576	
KV Gem	51550.2765	0.0013	I	-	−0.0082	type err.
	51569.2791	0.0024	I	-	−0.0071	normal min.
	51576.4544	0.0034	I	-	−0.0022	normal min.
	51569.4579	0.0016	II	-	−0.0076	
	51841.5778	0.0033	II	-	−0.0036	
	51876.5337	0.0021	I	-	−0.0033	
	51909.5178	0.0023	I	-	−0.0030	normal min.
V342 Her	51657.4195	0.0040	I	V	0.0041	normal min.
V719 Her	51675.4359	0.0031	I	-	0.0503	type err.
	51672.4321	0.0029	I	-	0.0693	
	51697.4908	0.0027	I	-	−0.0622	
V789 Her	51675.4214	0.0090	II	R	0.0002	
	51672.5415	0.0016	II	R	0.0008	
	51679.4237	0.0019	I	R	0.0018	
	51814.3217	0.0027	II	R	−0.0036	
	51721.5116	0.0055	II	R	0.0024	
GN Hya	51608.4179	0.0022	I	-	−0.0910	normal min.
	51626.4182	0.0019	I	-	−0.0871	
EL Lac	51799.5457	0.0021	I	-	0.1335	
GH Lac	51776.5293	0.0030	I	-	−0.1207	
	51848.4313	0.0033	I	-	−0.1258	normal min.
	51841.5150	0.0024	I	-	−0.1177	normal min.

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
HX Lac	51781.4402	0.0015	I	-	-0.0666	
KO Lac	51697.4261	0.0106	I	-	0.1232	normal min.
	51778.4849	0.0068	I	-	0.1222	normal min.
LU Lac	51841.4765	0.0063	I	-	0.0344	normal min.
NR Lac	51776.4977	0.0089	I	-	0.0624	
RW Leo	51626.4107	0.0023	I	-	-0.0539	
	51685.3088	0.0026	I	-	-0.0453	normal min.
BL Leo	51576.6248	0.0041	I	-	-0.0118	normal min.
	51635.5443	0.0023	I	-	-0.0158	normal min.
	51672.3383	0.0028	II	-	-0.0138	normal min.
BW Leo	51576.5847	0.0028	I	-	-0.0788	normal min.
	51672.3955	0.0022	I	-	-0.0388	
Z Lep	51576.4053	0.0035	I	-	-0.1488	normal min.
AH Lyn	51608.4526	0.0017	I	-	-0.0046	
DT Lyr	51675.5236	0.0020	I	R	0.1187	
KT Lyr	51635.5212	0.0034	I	-	-0.0038	normal min.
MN Lyr	51635.5648	0.0023	I	-	0.0371	
PY Lyr	51657.5855	0.0117	I	R	-0.0046	
	51776.4056	0.0020	I	-	-0.0038	
	51777.3679	0.0015	I	-	-0.0059	
	51777.5628	0.0022	II	-	-0.0039	
	51841.2185	0.0019	I	-	-0.0014	normal min.
V361 Lyr	51675.3972	0.0032	I	R	-0.0394	normal min.
	51697.5378	0.0030	II	R	-0.0363	normal min.
	51811.3154	0.0012	I	R	-0.0426	
	51811.4678	0.0046	II	R	-0.0450	
	51814.4105	0.0059	I	R	-0.0437	
	51841.3465	0.0063	I	R	-0.0443	
V412 Lyr	51675.5352	0.0019	I	R	0.1257	
V417 Lyr	51675.4694	0.0092	I	R	0.0408	
V429 Lyr	51679.4262	0.0087	I	-	0.1114	
	51694.3647	0.0080	I	-	0.1036	normal min.
V431 Lyr	51675.4504	0.0031	I	R	0.0217	
V563 Lyr	51635.5465	0.0015	I	-	0.0046	
	51657.4959	0.0087	I	-	0.0037	normal min.
	51757.4290	0.0049	I	-	0.0052	
VX Mon	51550.3668	0.0039	I	-	-0.6976	normal min.
BH Mon	51550.2904	0.0042	I	-	-0.1541	normal min.
CP Mon	51876.5447	0.0035	I	-	0.0194	
GU Mon	51876.5275	0.0049	I	-	0.0646	
V396 Mon	51841.5354	0.0078	I	-	-0.0458	
V524 Mon	51576.4718	0.0043	II	-	-0.0200	normal min.
	51876.5404	0.0027	II	-	-0.0184	
V532 Mon	51569.4149	0.0052	I	-	-0.1734	
V981 Oph	51814.3105	0.0015	I	-	-0.0221	normal min.
CQ Ori	51876.5181	0.0033	I	-	0.0044	
	51550.4470	0.0031	I	-	0.0124	normal min.
DZ Ori	51876.5394	0.0097	I	-	-0.2013	
EG Ori	51550.3378	0.0019	I	-	-0.0713	
GU Ori	51799.6057	0.0022	I	-	-0.0283	
	51626.3930	0.0039	I	-	-0.0299	normal min.
OS Ori	51576.3420	0.0025	I	-	-0.0214	
CH Per	51576.2907	0.0031	I	-	-0.0672	normal min.
EQ Per	51841.6172	0.0085	I	-	0.4071	
FW Per	51569.3362	0.0037	I	-	-0.1028	normal min.
	51626.3033	0.0013	I	-	-0.1036	

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
II Per	51550.3045	0.0054	II	-	−0.0470	
	51569.2585	0.0072	I	-	−0.0472	normal min.
	51569.4964	0.0022	II	-	−0.0492	
PS Per	51876.4201	0.0017	I	-	0.0587	
	51841.3121	0.0058	I	-	0.0595	normal min.
V434 Per	51626.3446	0.0044	I	-	0.1264	normal min.
V Sge	51781.3817	0.0063	I	-	−0.0258	
AP Tau	51626.3206	0.0017	I	-	0.0163	
V Tri	51752.4989	0.0015	I	-	0.0006	
RS Tri	51772.5360	0.0076	I	-	−0.0130	
RV Tri	51772.4598	0.0014	I	-	−0.0184	
ST Tri	51550.2864	0.0031	I	-	−0.0380	
	51841.5494	0.0030	I	-	−0.0396	
23360281 Tri	51550.3066	0.0031	I	-	−0.0052	new var.
	51576.3157	0.0025	II	-	0.0124	
	51576.3169	0.0046	II	V	0.0136	
	51576.3173	0.0063	II	R	0.0140	
	51771.4704	0.0051	I	-	0.1374	
	51771.4723	0.0060	I	R	0.1393	
	51841.4510	0.0019	II	-	−0.0029	
	51841.6388	0.0014	I	-	−0.0021	
	51876.4423	0.0016	I	-	0.0214	
AX Vir	51675.5264	0.0061	I	-	0.0034	normal min.
BH Vir	51580.6642	0.0023	I	-	−0.0064	
RR Vul	51778.4495	0.0089	I	-	−0.0580	normal min.
FF Vul	51776.4708	0.0027	I	-	−0.0002	

Explanation of the remarks in the table:

DH = the second observer Hanžl, D.; new var. = variability of the star was discovered by author, more details will be published soon; normal min. = times of minima were obtained by superposition of two or more parts of light curve from different nights.; type err = the type of variable star given in GCVS is wrong, new details will be published soon.

Remarks:

The timings of minima presented in this fourth list were obtained from the CCD observations of the author (in one case together with D. Hanžl) in 2000. These observations are used especially to improve the light elements of stars given in catalogue BRKA of observing programme of eclipsing binaries of BRNO-Variable Star Section. The catalogue contains more than 1500 eclipsing binaries and it is updated at least one times per year. It is available on `http://var.astro.cz/brno`.

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COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

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NSV 12364: A SEMIREGULAR VARIABLE

BEDIENT, J. R.

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Name of the object:
NSV 12364 = USNO A2.0 0825-16831668 = IRAS 19422-0054 = GSC 0514500383 = 2MASSI J1944495-004656

Equatorial coordinates:	**Equinox:**
R.A.= $19^h44^m49\overset{s}{.}504$ **DEC.=** $-0°46'56\overset{''}{.}76$	2000.0

Observatory and telescope:
University of Illinois at Urbana-Champaigne, Stardial

Detector:	Kodak KAF-400 CCD

Filter(s):	RG-1

Date(s) of the observation(s):
JD 2 450 289 – 2 452 185

Comparison star(s):	GSC 0514501789 = USNO A2.0 0825-16834586

Check star(s):	GSC 0514500716 = USNO A2.0 0825-16788287

Transformed to a standard system:	No

Availability of the data:
At the IBVS website: 5288-t1.txt

Type of variability:	SRA

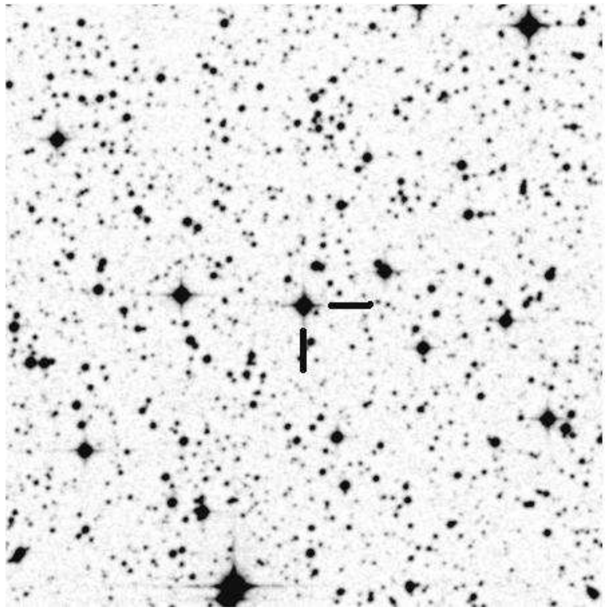

Figure 1. Identification chart: Field of NSV 12364. North is up and East is left on this 7!5 × 7!5 section of a red plate from the UK Schmidt Telescope. Tick marks identify the variable. Image obtained from the Digitized Sky Survey.

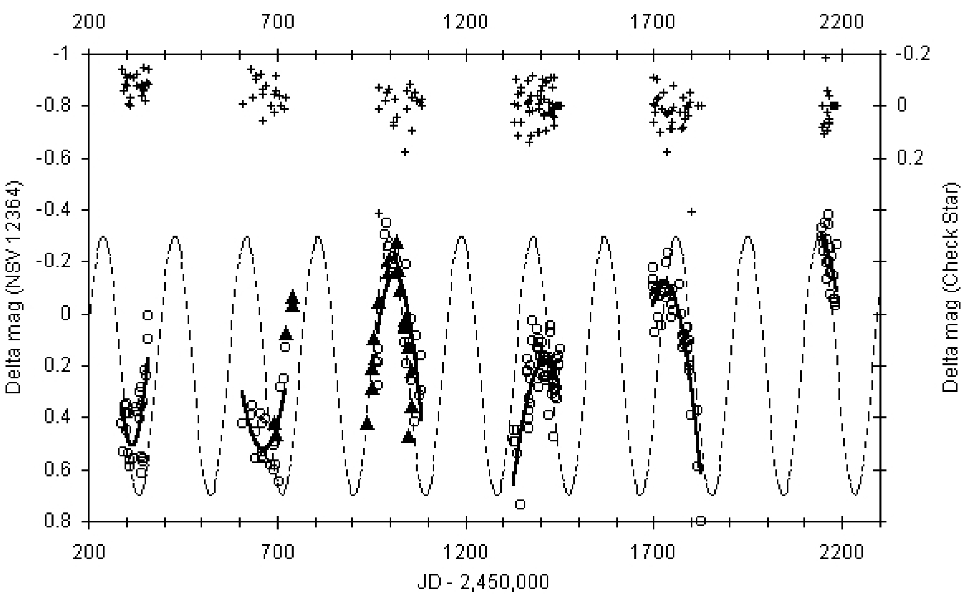

Figure 2. Light Curve of NSV 12364. Open circles represent Stardial data, filled triangles are TASS Mark III I-band data, and crosses represent the check star. Dark curves are simple second-order polynomial fits to each season's data, and a dashed sine curve representing the best-fit period, 190 days, is overlaid.

Remarks:

This star was detected as variable while blinking Stardial (McCullough and Thakkar, 1997) images. It was first noted as a possible variable by Ross (1928) and was catalogued as NSV 12364 on the basis of that observation (Kholopov et al., 1998). All available Stardial images of the region were analysed. 185 images covering portions of six observing seasons 1996–2001 were found suitable for differential photometry. The results, along with 27 TASS (Richmond et al. 2000) I-band observations (converted to differential magnitudes) are plotted in Figure 2. A simple graphical fit yields a period of 190 days, but the actual maxima and minima may derivate from this fit by $\pm 40^{\mathrm{d}}$. Simultaneous V and I band observations by TASS show a $V - I$ color index of 3.72 magnitudes at maximum. This corresponds to a spectral type of M4 - M5 (Zombeck 1990). A significant infrared excess was observed by IRAS (12 μ flux 1.37 Jy, 25 μ flux 4.72×10^{-1} Jy, Moshir et al., 1989) and the Two Micron All-Sky Survey (2MASS J-band magnitude 6.037; H and K_s bands saturated). The picture that emerges is that of a mildly variable late-type star probably surrounded by a thick infrared-emitting dust shell, i.e. a typical asymptotic giant branch star. The color, amplitude and variable period direct the classification of this star as SRA.

Acknowledgements:

This research has made use of NASA's Astrophysics Data System Bibliographic Services, and the VizieR catalogue access tool, CDS, Strasbourg, France.
The Digitized Sky Surveys were produced at the Space Telescope Science Institute under U.S. Government grant NAG W-2166. The images of these surveys are based on photographic data obtained using the Oschin Schmidt Telescope on Palomar Mountain and the UK Schmidt Telescope. The plates were processed into the present compressed digital form with the permission of these institutions.
This publication makes use of data products from the Two Micron All Sky Survey, which is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center/California Institute of Technology, funded by the National Aeronautics and Space Administration and the National Science Foundation.

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DISCOVERY OF FOUR CLOSE BINARY STARS IN SAGITTARIUS

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This Note is the second in a series of Notes where we report new variable stars discovered during our extensive CCD monitoring program of the black hole binary V4641 Sgr (SAX J1819.3-2525) (Orosz et al., 2001). In this Note we report on the discovery of four close binary stars (i.e. binaries where the radius of one or both stars is a substantial fraction of the orbital separation).

The reader is referred to our first Note (Gieles et al., 2002) for a complete discussion of the telescopes and data reduction techniques used. Briefly, CCD observations in the U, B, V, R, and I filters were collected between July 2000 and October 2001 using 4 different 1m class telescopes. We have the light curves of about 15 000 stars in a $9' \times 9'$field. We searched for variables by comparing the standard deviation σ of the light curves and by computing the maximum power in a Lomb-Scargle periodogram (Lomb 1976, Scargle 1982) for each star. These two techniques are well suited for finding either large amplitude variables (these have large values of σ) or smaller amplitude periodic variables (these have large L-S power). Although it is difficult to be quantitative about our completeness for finding variables, we believe our completeness is reasonably high.

Table 1. Photometric data.

Coordinates (J2000)	V	average $V-I$	period (days)	Type of variable
18:19:24.8 −25:24:56.6	17.5 – 18.1	0.82	0.3668	ellipsoidal
18:19:00.9 −25:24:12.1	14.6 – 14.8	1.22	77.0	ellipsoidal
18:19:07.8 −25:27:15.0	15.8 – 15.2	0.85	0.464	W UMa
18:19:24.4 −25:25:53.5	16.4 – 18.1	0.75	0.8273	Algol

We found four stars which are close binary stars. Table 1 gives an overview of the photometric information of the four sources identified. Figs. 1 to 4 show the light curves for each source in different bands. Figs. 5 to 8 show the finding charts for each source. As in our previous Note, the names of the stars are based on their coordinates in equinox

2000 and are given the prefix YALO since most of the variables were discovered with the data of the YALO telescope (Bailyn et al. 1999). None of these sources appear in SIMBAD.

The light curves of YALO J181924.8-252457 and YALO J181900.9-252412 give a strong suggestion that these sources are close binaries where at least one star (nearly) fills its Roche lobe. Since YALO J181900.9-252412 has a relatively long period of 77 days, the star which dominates the light is probably a K giant as it is in the well-known binary 5 Ceti (Eaton and Barden 1988).

YALO J181907.8-252715 is most probably a W UMa type binary (Moss and Whelan, 1970) in which both star overfill their Roche lobes. The two stars probably have nearly the same temperature since the minima are of nearly equal depth.

YALO J181924.4-252554 is most probably an Algol variable.

References:

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Scargle, J.D., 1982, *ApJ*, **263**, 835

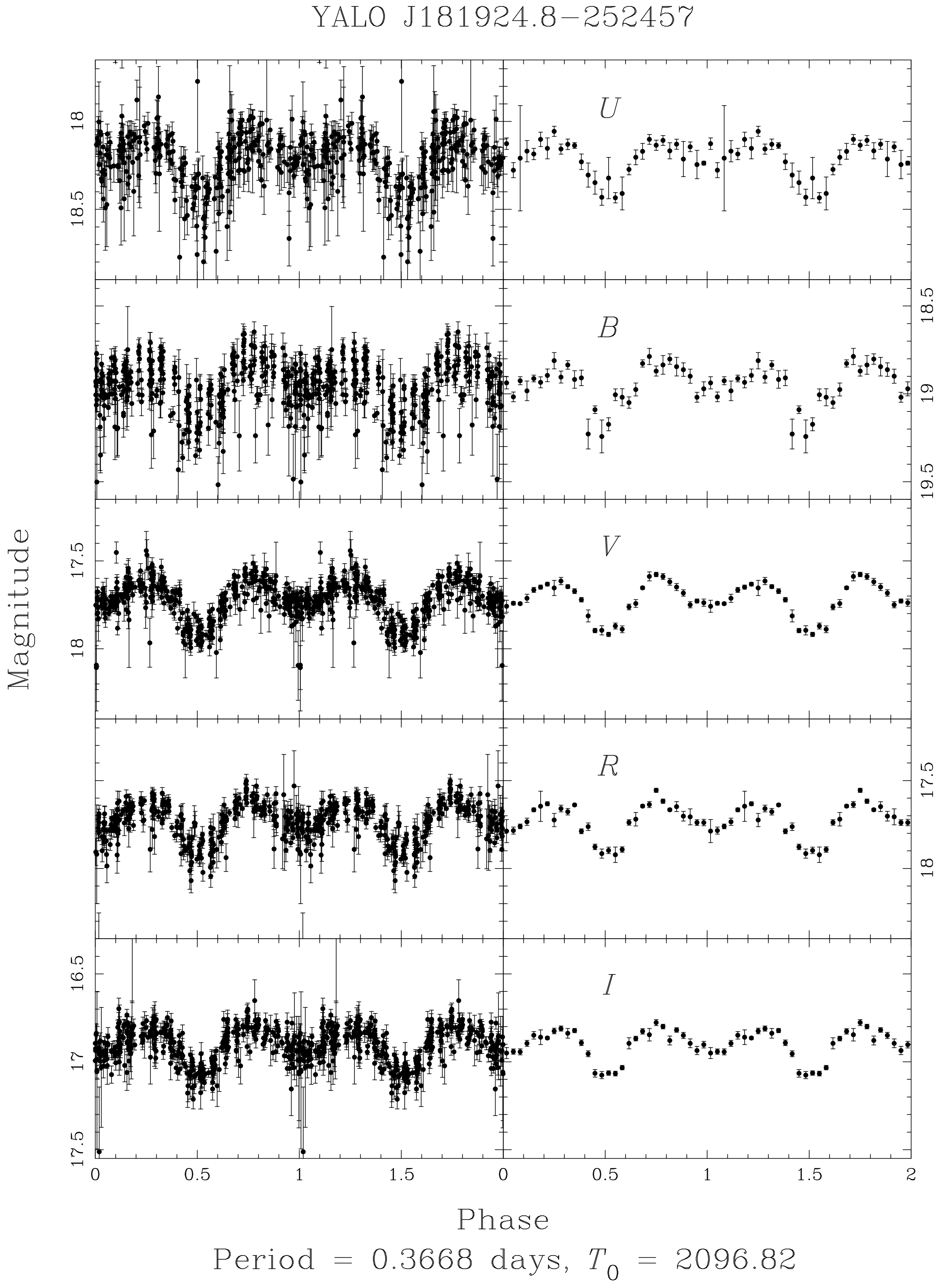

Figure 1. Folded light curves of YALO J181924.8-252457. Left: unbinned data. Right: data binned to 40 phase bins. T_0 is HJD 2 450 000+. Note: the U-band values are instrumental magnitudes.

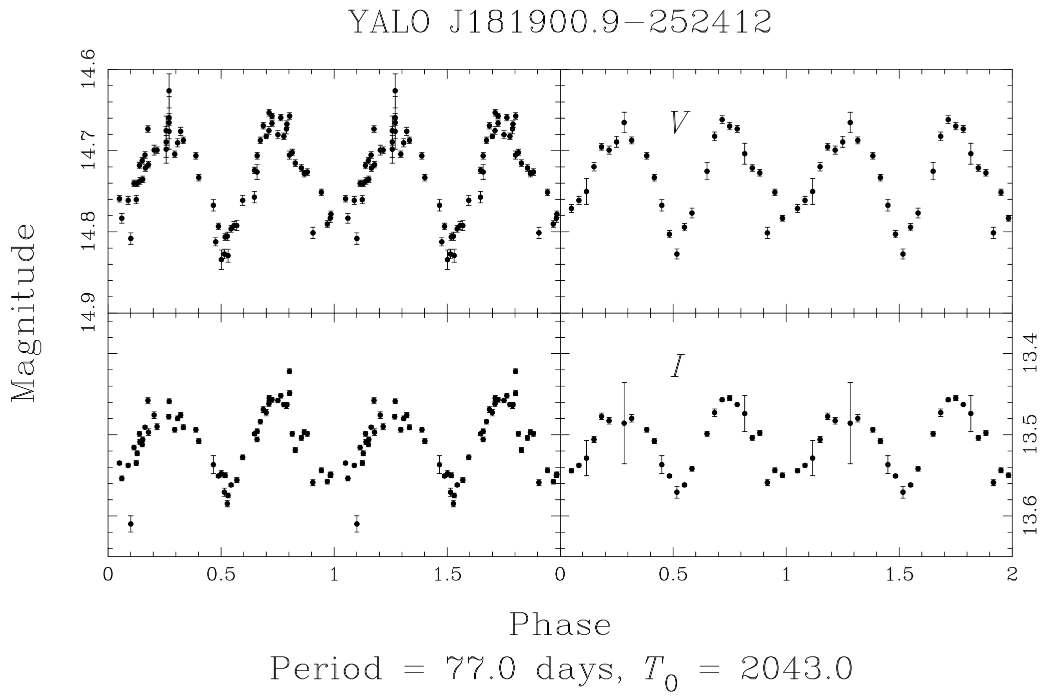

Figure 2. Folded light curves of YALO J181900.9-252412. Left: unbinned data. Right: data binned to 30 phase bins. T_0 is HJD 2 450 000+

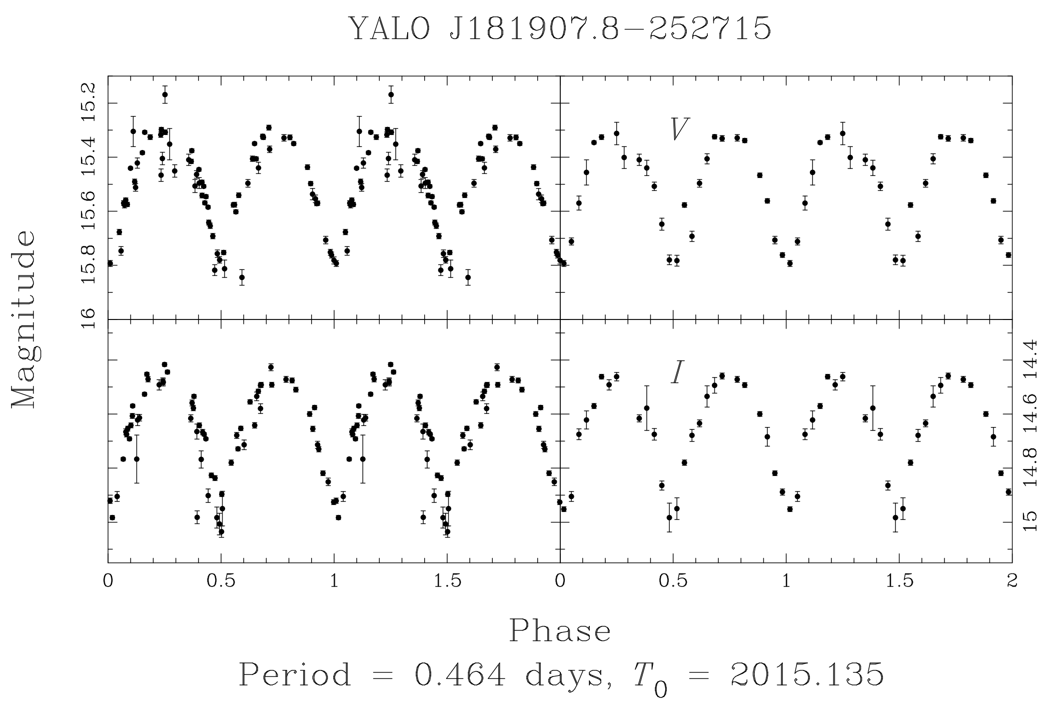

Figure 3. Folded light curves of YALO J181907.8-252715. Left: unbinned data. Right: data binned to 30 phase bins. T_0 is HJD 2 450 000+

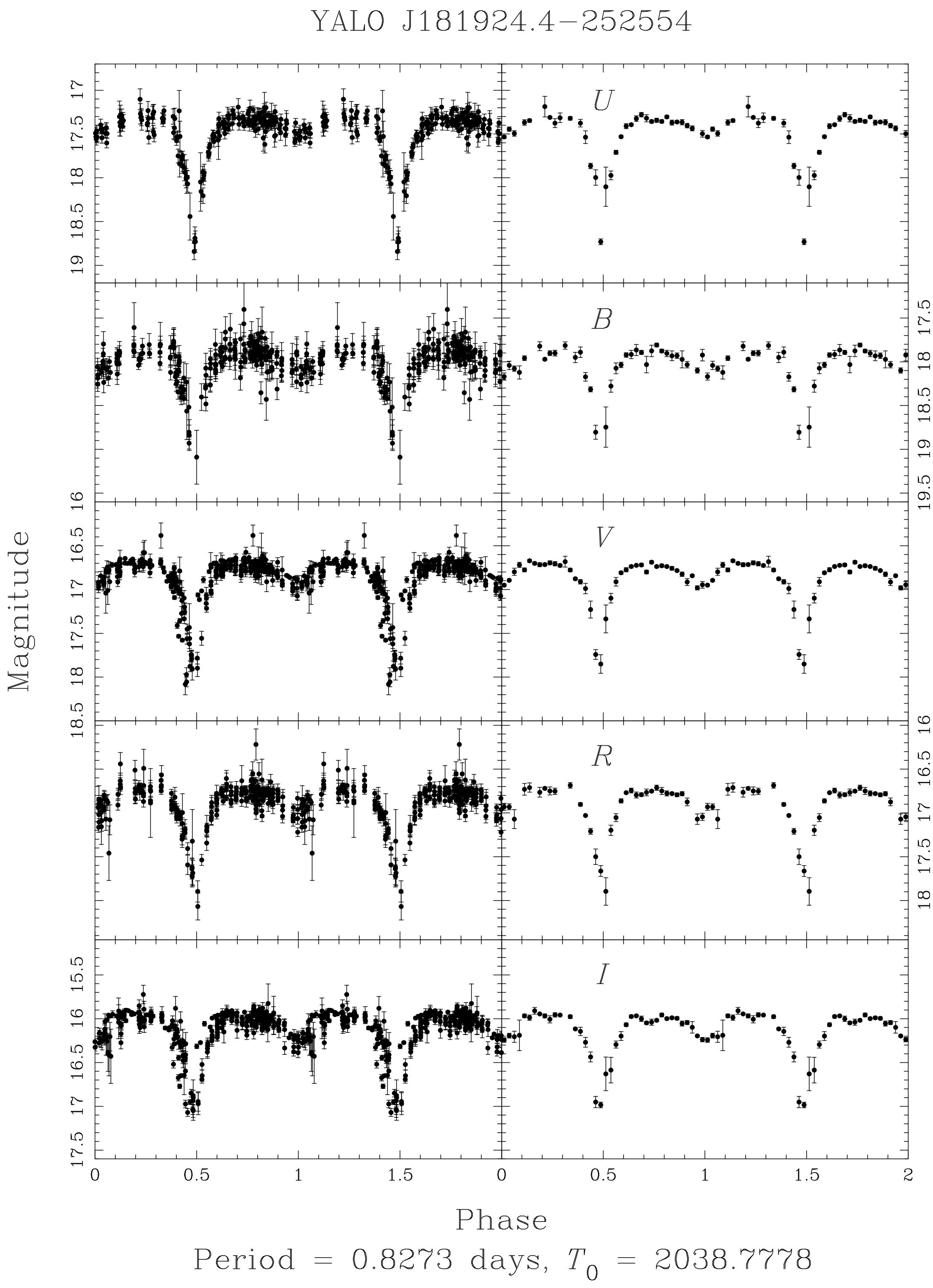

Figure 4. Folded light curves of YALO J181924.4-252554. Left: unbinned data. Right: data binned to 40 phase bins. Note: the U-band values are instrumental magnitudes. T_0 is HJD 2 450 000+

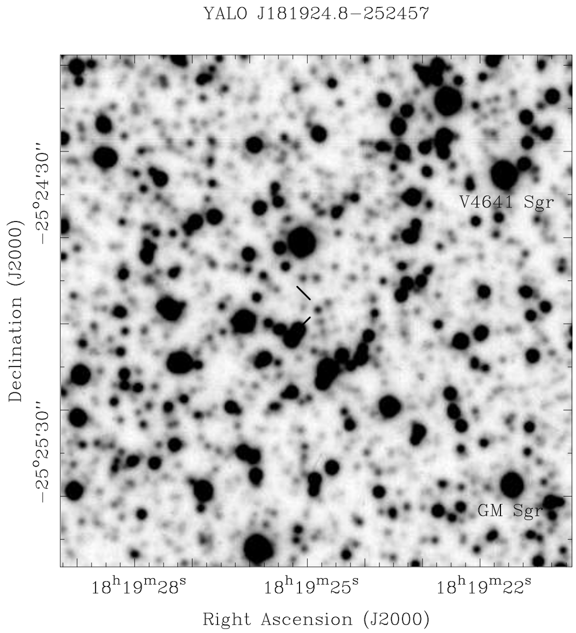

Figure 5. V-band finding chart of YALO J181924.8-252457. Source is in centre. Note: $\sim 3''$ to the west two known variable stars are indicated: V4641 Sgr which is a black hole binary and GM Sgr which is a Mira variable.

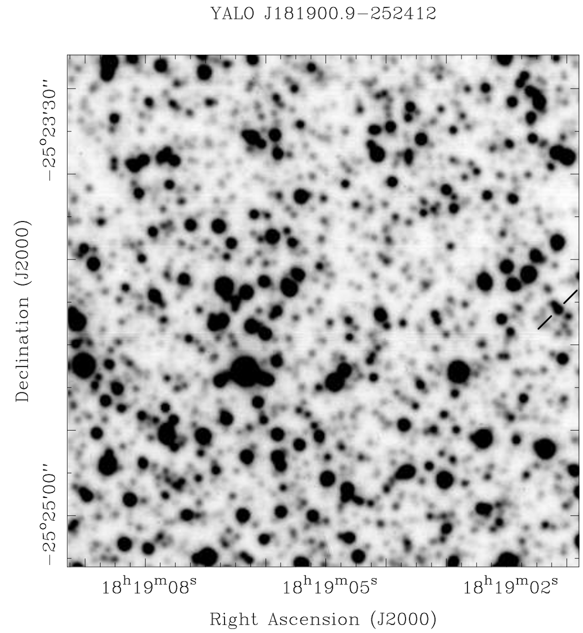

Figure 6. V-band finding chart of YALO J181900.9-252412. Source is right of centre.

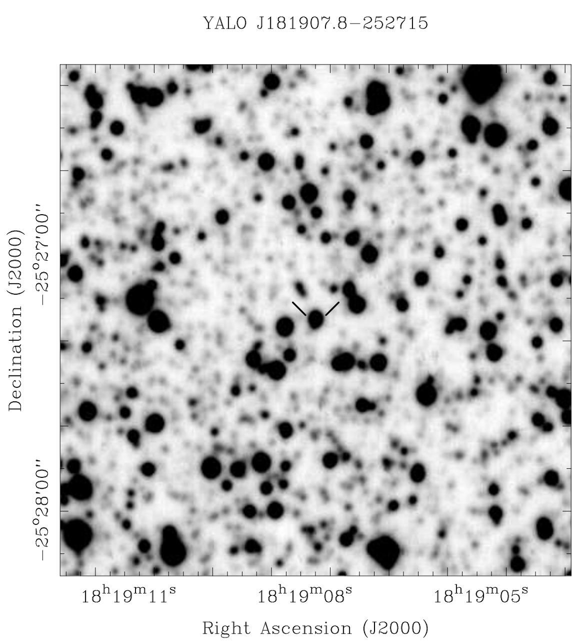

Figure 7. V-band finding chart of YALO J181907.8-252715. Source is in centre.

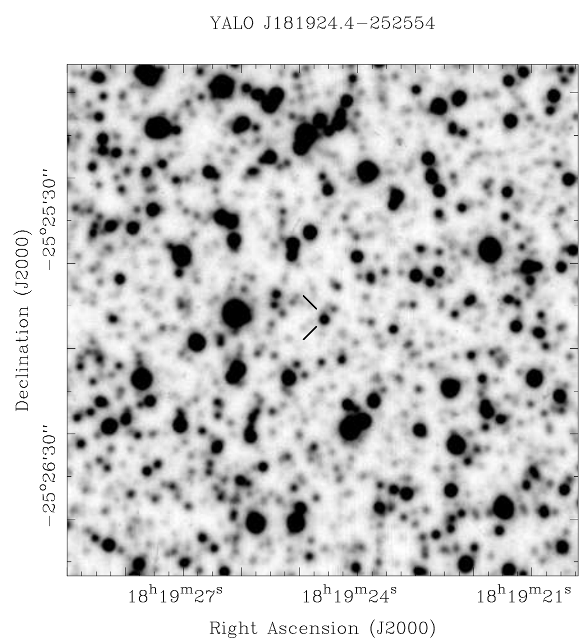

Figure 8. V-band finding chart of YALO J181924.4-252554. Source is in centre.

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THE DOUBLE-LINED SPECTROSCOPIC BINARY AV SCL

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We report the first detection of spectral lines from the companion star of the spectroscopic binary AV Scl (= HD 1909, B9 IV HgMn). Its SB1 nature had been noted from sporadic radial velocity measurements (Buscombe 1963, Buscombe & Kennedy 1968, Buscombe, Chambliss & Kennedy 1968, Hube 1970, Bond, Perry & Bidelman 1971) which span the range $\pm$ 30 km s^{-1} with an apparent period between 5 and 10 days. Variations in the Strömgren u band flux at the level of 0.030 magnitude with a period of 7.2 days were reported by Schneider (1987). The photometric variations should be interpreted cautiously due to photometric variability of the comparison stars used in that study. The brightness variations of AV Scl are characterized as being of the α^2 CVn type in the GCVS. Elemental abundances have been most recently studied by Adelman et al. (1996), and earlier by Buscombe, Chambliss, & Kennedy (1968) and Guthrie (1984). From these studies it is evident that AV Scl is a HgMn star, however, no detection of spectral lines from the secondary star had previously been reported.

Spectral observations of AV Scl were executed during program ESO 67D-0579(A) on 2001 June 23 with the Ultraviolet-Visual Echelle Spectrograph (UVES) on the Very Large Telescope of the European Southern Observatory. The spectra were taken using the dichroic-1 and -2 modes of the UVES with a slit width of $0\farcs4$ for the blue arm and $0\farcs3$ for the red arm. The spectral coverage is nearly complete from approximately 3100 Å to 1 μm. Average resolving powers of R = 80000 and 110000 are achieved for the UVES blue and red arms, respectively.

We have identified spectral lines of the binary companion over the entire range of the observed spectrum. Their strength is weaker than for the primary star lines for ions, while for the spectrum of Fe I the companion lines are more comparable to those of the primary. No detection of Hg II λ3984 is made for the secondary and lines of Mn II, while strong in the primary star spectrum, are not noticeable in the secondary. Therefore, it is unlikely that the companion is also a HgMn star. The relative velocity between the two stars is derived from wavelength shift of $\lambda_{pri} - \lambda_{sec} = -3.058$ Å for the Si II multiplet 2 $\lambda\lambda$6347, 6371 lines, which corresponds to the secondary lines being redshifted relative to the primary by 144.05 km s^{-1}. This relative velocity is consistent with spectral lines at other wavelengths. The figure illustrates spectral lines from both stars.

We have performed a preliminary analysis of the spectrum by its comparison with synthetic spectra generated using the ATLAS/SYNTHE codes while making the assumptions that the companion is a cooler main sequence star of solar-like chemical composition.

Reasonable fits to the spectrum are achieved using the atmospheric parameters T_{eff} = 12400 K, $\log g = 4.0$ for the primary and T_{eff} = 9000 K, $\log g = 4.0$ for the secondary. The luminosity ratio, $L_{pri}/L_{sec} = 12$ at 6350 Å, is determined from an equivalent width measurement technique (Wahlgren et al. 1994) using the lines Si II 6347, 6371 Å. Both stars display a projected equatorial rotational velocity of $v \sin i = 12$ km s^{-1} as determined from synthetic spectrum fitting of the observation.

The high relative velocity and implied spectral type (A4V) of the secondary star makes AV Scl appear similar to other cool HgMn binaries, such as χ Lupi, HR 4072, and ι CrB. Further consideration should be given to determine whether AV Scl is a multiple star system. The photometric variations, if real, are not known to exist in other HgMn stars and therefore may not be the result of rotational modulation of the flux. High precision photometric monitoring should be undertaken to determine whether observed flux variations are the result of an eclipsing system. In addition, spectral monitoring is needed to determine the orbital parameters and mass ratio before a more accurate determination of the atmospheric parameters and elemental abundances can be undertaken.

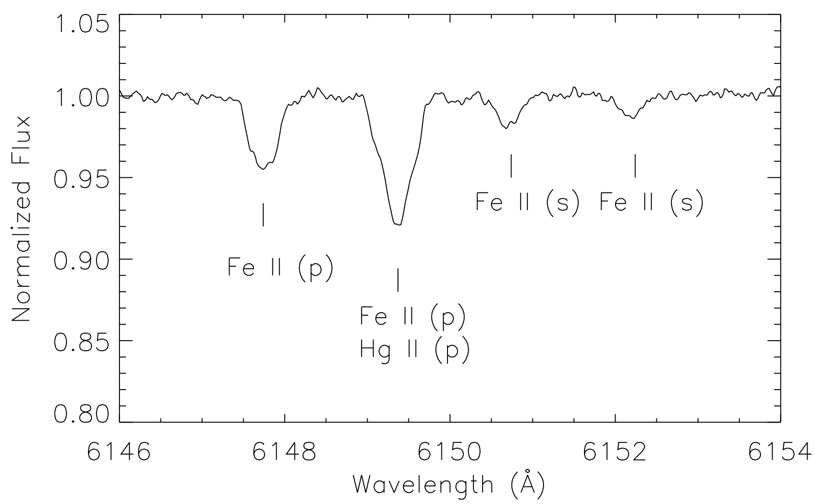

Figure 1. A portion of the spectrum of AV Scl displaying the lines Fe II λλ6147,6149 for both the primary (p) and secondary (s) components on date JD 2452074.441. The primary star spectrum has been shifted to the laboratory restframe.

References:

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14 June 2002

HU ISSN 0374 – 0676

OPTICAL MONITORING OF GM SGR AND DISCOVERY OF A MIRA AND A SHORT-PERIOD PULSATOR

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This Note is the third in a series of Notes where we report new variable stars discovered during our extensive CCD monitoring program of the black hole binary V4641 Sgr (SAX J1819.3-2525, Orosz et al. 2001). In this Note we report on the discovery of a Mira and a short-period pulsating star. We also give the light curves of GM Sgr, a previously known Mira (Orosz 2000, Kato et al. 2001).

The reader is referred to our first Note (Gieles et al. 2002) for a complete discussion of the telescopes and data reduction techniques used.

Table 1. Photometric data.

Coordinates (J2000)	V	average $V-I$	period (days)	T_0 (HJD 2 450 000+)	ID
18:19:36.7 -25:25:53.1	12.0 – 16.8	4.2	∼208	2015	...
18:19:21.5 -25:25:37.6	13.1 – 18.2	3.6	212	2010	GM Sgr
18:19:11.0 -25:23:20.3	18.3 – 17.4	1.5	0.163	2015.025	...

We found three stars that seem to be pulsating stars with well-defined periods. Only one of the three stars has been previously identified. YALO J181921.5-252538 is Luyten's variable GM Sgr (Luyten 1927), which in the past has been confused with V4641 Sgr. This star was spectroscopically classified as a Mira star by Orosz (2000). Kato et al. (2001) derived a photometric period of 212 days, in agreement with what we find here.

Table 1 gives an overview of the photometric information of the three sources identified, including coordinates, magnitude and color ranges and ephemeris information (T_0 is the epoch of minimum light). Figs. 1 and 2 show light curves for each source in different bands. Figs. 3 and 4 show the finding charts for each source. As in our previous Notes, the names of the stars are based on their coordinates in equinox 2000 and are given the prefix YALO since most of the variables were discovered with the data of the YALO telescope (Bailyn et al. 1999).

YALO J181936.7-252553 is a Mira very similar to GM Sgr (i.e. they both have nearly the same period and V-band amplitude). YALO J181911.0-252320 is most probably a pulsating star of the δ Scuti type.

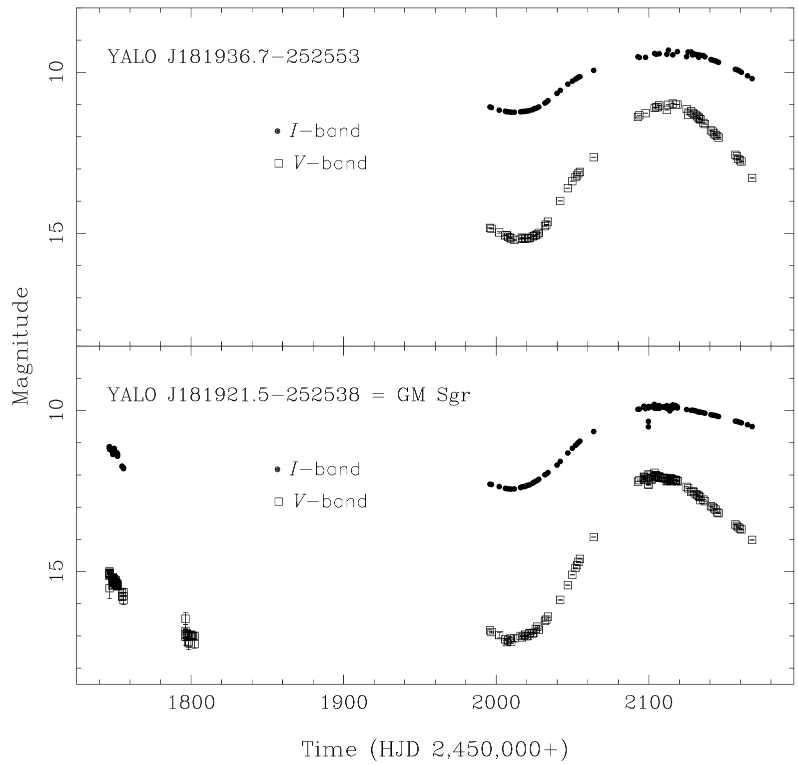

Figure 1. Top: light curves of YALO J181936.7-252553 in V and I. Bottom: light curves of YALO J181921.5-252538 = GM Sgr in the V and I band

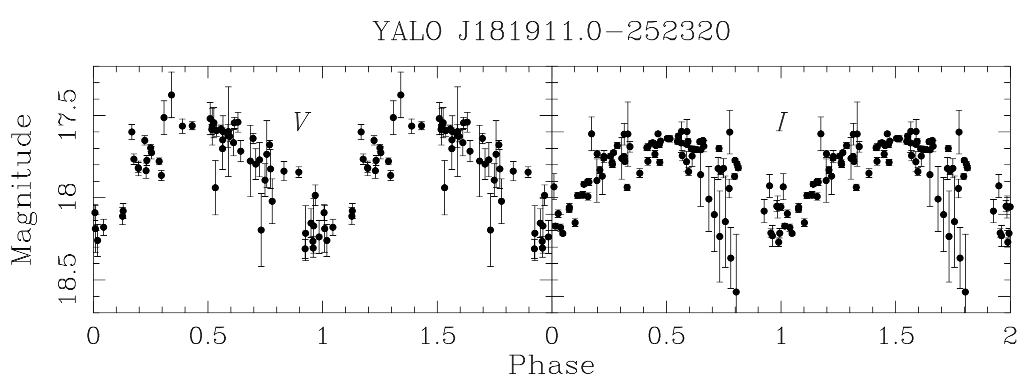

Figure 2. Folded light curves of YALO J181911.0-252320. Left: V-band. Right: I-band.

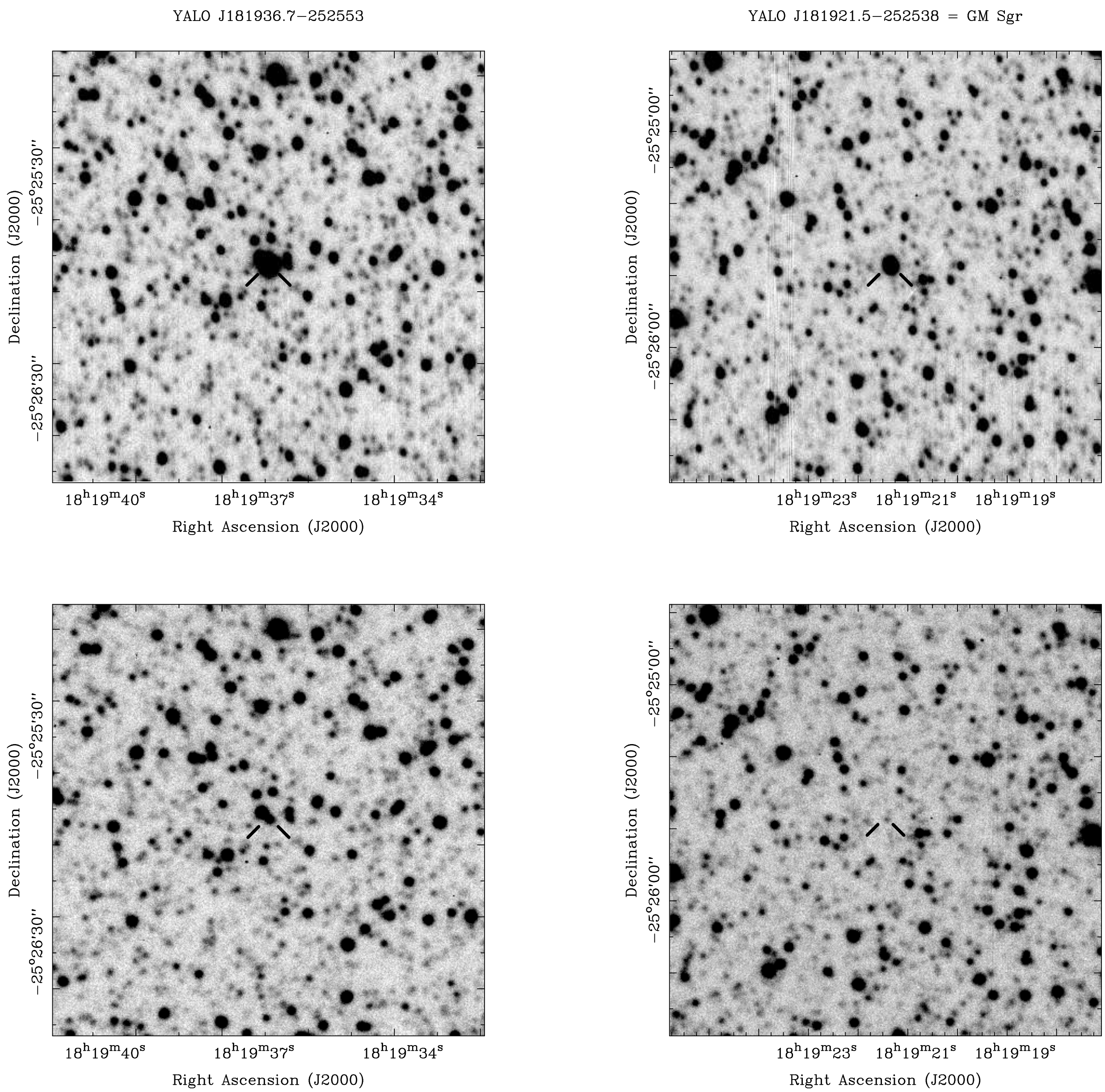

Figure 3. V-band finding charts of YALO J181936.7-252553 (left column) and GM Sgr = YALO J181921.5-252538 (right column). The top row shows single frames in which both sources are at maximum brightness. The second row shows single frames in which both sources at minimum brightness.

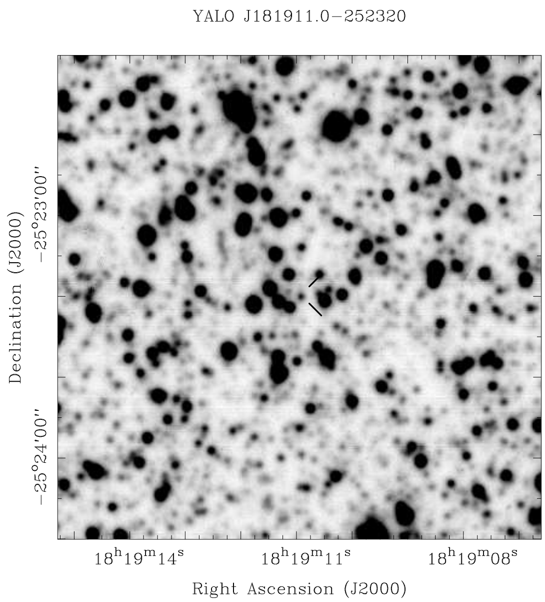

Figure 4. V-band finding chart of YALO J181911.0-252320. Source is in centre.

References:

Bailyn, C.D., Depoy, D., Agostinho, R., Mendez, R., Espinoza, J., & Gonzalez, D., 1999, *BAAS*, **31**, 1502

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HU ISSN 0374 – 0676

GSC 2038_1730: A NEW VARIABLE STAR

ZHANG, X.B.; ZHANG, R.X

National Astronomical Observatories, Chinese Academy of Sciences and Beijing Astrophysics Center, 100012, Beijing, China, email: xzhang@bao.ac.cn

Name of the object:
GSC 2038_1730

Equatorial coordinates:	**Equinox:**
R.A.= $16^h07^m30\overset{s}{.}99$ **DEC.**= $+27°13'31\overset{''}{.}2$	J2000

Observatory and telescope:
Beijing Astronomical Observatory, 85-cm Cassegrain telescope

Detector:	TH7882 CCD, 576 × 384 pixels

Filter(s):	V

Date(s) of the observation(s):
2000.04.28, 29, 30; 2000.05.06, 07, 10

Comparison star(s):	GSC 2038_1381

Check star(s):	GSC 2038_1473

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	Unknown

Remarks:
We made a CCD photometry on the eclipsing binary TW CrB in 2000. For the observations, the star GSC 2038_1730 was employed as one of the reference stars. During the data reduction, we find that it is a variable star with peculiar light curve. The full amplitude of light variations is larger than 1.5 mag. The period and the type of variability remain unknown.

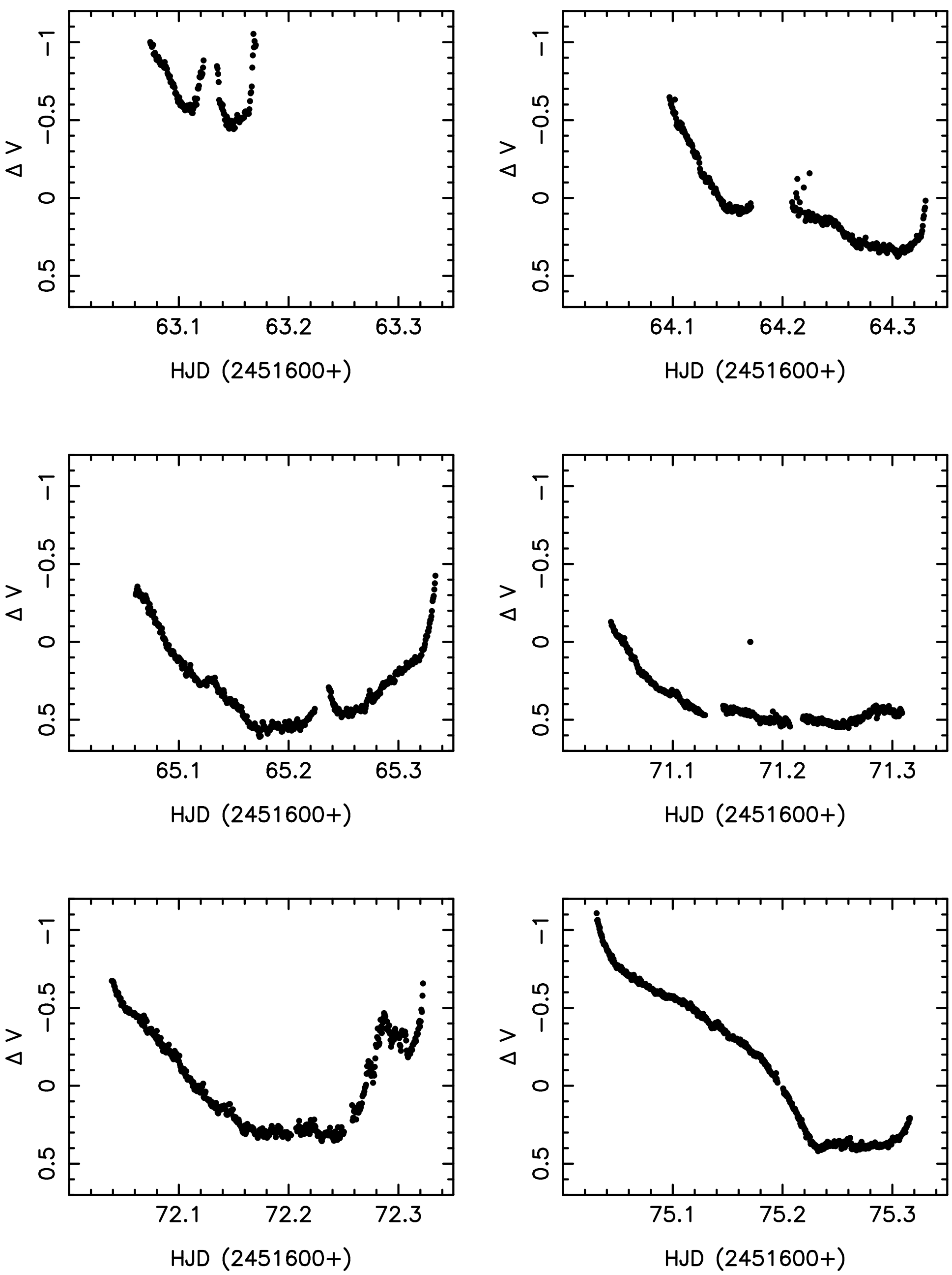

Figure 1. The real-time light curves of GSC 2038_1730

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A POSSIBLE PERIODIC TERM IN THE PERIOD OF THE ECLIPSING BINARY V701 Sco

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The early-type (B1) eclipsing binary V701 Scorpii (also HD 317 844, HIP 85985, CD −32 12924), due to its membership in the open cluster NGC 6383, was studied several times: spectroscopically by Andersen et al. (1980) and photometrically e.g. by Bell & Malcolm (1987). Its period is apparently variable, as found already by Andersen et al. (1980). These authors invoked large mass transfer to explain the variability; however, Bell & Malcolm (1987) did not confirm any large period change and noted that there is some evidence of small-scale period changes only.

One of us (MW) recently measured a part of a minimum using the 0.84-m telescope at San Pedro Mártir Observatory (Baja California, Mexico). Only the rising part of the minimum was catched, nevertheless the time of the minimum can be estimated when the data are compared with measurements by Bell & Malcolm (1987) or Lorenz et al. (1991). In Table 1, all available times of minimum light are collected; in agreement with previous studies, the minimum time published by Bruton & Chambliss (1985) is not considered. In the column $O-C_1$ the values calculated using the ephemeris by Bell & Malcolm are given:

$$\text{Pri.Min.} = \text{HJD } 2446199.5059 + 0\overset{\text{d}}{.}76187645 \cdot E,$$

and in the column $O-C_2$ are values according to a somewhat arbitrary ephemeris

$$\text{Pri.Min.} = \text{HJD } 2446199.4850 + 0\overset{\text{d}}{.}7618728 \cdot E.$$

The $O-C_2$ values are displayed in Fig. 1. It can be observed that there might be a periodic term in $O-C$ values, and a sine curve is also shown. Its semiamplitude is $0\overset{\text{d}}{.}028$, period 67 years, phase zero at JD 2442390; these values are however constrained only weakly. In case the periodic change is due to a third body, the mass function is 0.0256 $M_\odot$ and the minimum third body mass is 2.2 $M_\odot$ (a better fit would be obtained assuming nonzero eccentricity of the third body orbit). If the periodic behaviour is confirmed, no assumption of mass exchange is necessary.

Table 1: Times of minima of V701 Sco

HJD−2400000	Error [days]	Epoch	$O-C_1$ [days]	$O-C_2$ [days]	Source
27943.5114	0.010	−23962	0.0890	0.0224	1
28545.3648	0.012	−23172	0.0600	−0.0037	1
39330.0455	–	−9016.5	−0.0014	−0.0134	2
39331.9516	–	−9014	0.0000	−0.0120	2
39341.8572	–	−9001	0.0012	−0.0107	2
43574.8358	0.0002	−3445	−0.0057	0.0026	3
46199.5059	0.0003	0	0.0000	0.0209	4
46201.4110	0.0005	2.5	0.0004	0.0213	4
46569.3960	0.0003	485.5	−0.0009	0.0218	4
46598.3489	0.0003	523.5	−0.0007	0.0235	4
48070.6727	0.0002	2456	−0.0018	0.0281	5
48071.8152	0.0002	2457.5	−0.0021	0.0278	5
48072.5777	0.0002	2458.5	−0.0015	0.0284	5
48704.1699	0.0011	3287.5	−0.0048	0.0281	6
48704.5510	0.0018	3288	−0.0047	0.0282	6
52385.9046	0.0035	8120	−0.0381	0.0125	7

Source 1: from the data by Plaut (1948) two groups were formed and their mean values are listed, 2: Leung (1974), 3: Andersen et al. (1980), 4: Bell & Malcolm (1987), 5: Lorenz et al. (1991), 6: HIPPARCOS; ESA (1997); a time is given in the Hipparcos Catalogue, here we give times calculated from two minima covered by HIPPARCOS photometry, 7: this paper.

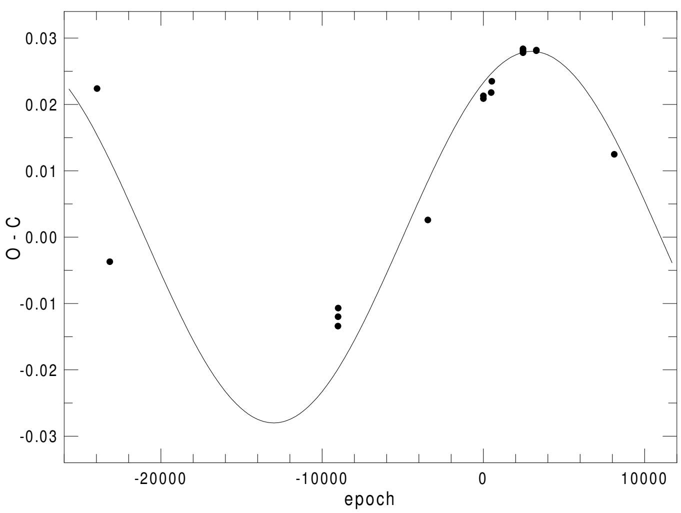

Figure 1. $O-C$ graph of V701 Sco.

References:

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Bell, S.A., & Malcolm, J., 1987, *MNRAS*, **226**, 899
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ESA 1997, *Hipparcos and Tycho Catalogue*, ESA SP-1200, Noordwijk
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Lorenz, R., Mayer, P., & Drechsel, H., 1991, *IBVS*, No. 3629
Plaut, L., 1948, *Leiden Ann.*, **20**, 1

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UBVR PHOTOMETRY OF THE ECLIPSING BINARY STAR V443 CYGNI

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[2] Department of Physics, National University of Uzbekistan, Vuzgorodok, Tashkent, 700174, Uzbekistan, e-mail: astro@nuuz.uzsci.net

Name of the object:
V443 Cyg = AN 540.1936 = GSC 03152-1283 = P5411

Equatorial coordinates:	**Equinox:**
R.A.= $20^h27^m45^s$ **DEC.=** $+38°41'24''$	2000.0

Observatory and telescope:
Maidanak Observatory of Astronomical Institute of Uzbek Academy of Sciences, 0.6-m Cassegrain telescope.

Detector:	Single channel photometer.

Filter(s):	$UBVR_J$

Date(s) of the observation(s):
2000.07.23 - 2000.08.26; 2001.07.13 - 2001.08.22.

Comparison star(s):	SAO 70055 = BD +38°4098 = GSC 03152-0050721

Check star(s):	SAO 70047 = BD +38°4092 = GSC 03152-0025322

Transformed to a standard system:	Yes
Standard stars (field) used:	SA 113 (Landolt,1983)

Availability of the data:
Upon request

Type of variability:	EA

V443 Cyg was discovered to be variable by Hoffmeister (1936). It was classified as a short period eclipsing star with $0\overset{d}{.}83110$ period and light changes between 12.3−12.9 pg (Richter, 1958; Schewick, 1941). We have been monitoring the binary for a total of 45 nights from July to August in 2000 and 2001. Table 1 lists the standard V magnitude and color indices of field stars near the variable. The photometric values have been determined by our measurements of the standards in the SA 113 (Landolt, 1983). We have found the following moments of primary minimum: HJD 2451774.5032 ± 0.0049, 2452115.2329 ± 0.0040. The analysis of light curves proved that the period of the binary is twice longer than initially determined. Using 53 moments of minima published in the literature and our determinations (Table 2 for primary minima, Table 3 for secondary ones), the following new ephemeris for V433 Cyg was yielded:

$$\begin{array}{rl} \text{Min I} = \text{HJD}2452115.2316 & + \; 1\overset{d}{.}66220545 \times \text{E} \\ \pm \; 0.0038 & \pm \; 0.00000043 \end{array}$$

Table 1

Star	V	$U-B$	$B-V$	$V-R$	Sp
Comparison(s)	8.915±0.011	0.462 ±0.024	0.900±0.014	0.551±0.006	B91b
Check(s)	8.436±0.004	1.048 ±0.006	1.124±0.002	0.850 ±0.003	K2

Table 2

Observer	HJD 2400000+	E	$O-C$
Richter (1958)	26206.465	−15587	0.027
Schewick (1941)	27298.497	−14930	−0.007
Richter (1958)	27298.500	−14930	−0.004
Schewick (1941)	27313.464	−14921	−0.000
Richter (1958)	27313.467	−14921	0.002
	28435.434	−14246	−0.018
	28819.424	−14015	0.002
	30375.253	−13079	0.006
	31703.363	−12280	0.014
	32775.456	−11635	−0.015
	33204.308	−11377	−0.012
	33887.457	−10966	−0.029
	35275.449	−10131	0.020
	35629.479	−9918	0.001
Romano (1969)	36751.500	−9243	0.033
	37130.430	−9015	−0.019
	37190.320	−8979	0.031
	37848.507	−8583	−0.015
	39788.292	−7416	−0.024
	40117.429	−7218	−0.004
Borovicka (1992)	47670.496	−2674	0.002
Dedoch (1992)	47670.501	−2674	0.007
Zejda et al. (1995)	48222.346	−2342	0.000
	48222.351	−2342	0.004
	49171.452	−1771	−0.013
	49171.460	−1771	−0.005
	49171.468	−1771	0.002
	49181.433	−1765	−0.006
	49186.418	−1762	−0.007
	49186.420	−1762	−0.005
	49186.425	−1762	−0.000
	49186.426	−1762	0.000
	49186.426	−1762	0.000
	49595.350	−1516	0.022
Diethelm (1995)	49919.457	−1321	−0.000
This paper	51774.503(5)	−205	0.023
	52115.233(4)	0	0.001

Table 3

Observer	HJD 2400000+	E	$O-C$
Schewick (1941)	25841.571	−15806.5	−0.010
Richter (1958)	29488.456	−13612.5	−0.004
	35369.359	−10074.5	0.016
	36072.453	−9651.5	−0.003
	36127.322	−9618.5	0.013
	36137.293	−9612.5	0.011
Romano (1969)	37149.543	−9003.5	−0.022
	37174.522	−8988.5	0.024
	37224.385	−8958.5	0.021
	37523.504	−8778.5	−0.057
	39699.373	−7469.5	−0.015
	40053.426	−7256.5	−0.011
Zejda et al. (1995)	49599.483	−1513.5	−0.000
Safar, Zejda (2000a)	50234.446	−1131.5	0.000
Dedoch (1997)	50583.499	−921.5	−0.010
Safar, Zejda (2000b)	50947.5353	−702.5	0.003

The phased U,B,V,R light curves are presented in Figure 1. The depth of the primary and secondary minima are $0^m_.65$ and $0^m_.46$, respectively. Table 4 represents photometric values for main phases of the binary's light curves. The brightness levels at the first and second quadratures are slightly different.

Table 4

Ph	V	$U-B$	$B-V$	$V-R$
Max.	12.30	0.05	0.57	0.46
Min. I	12.95	0.01	0.66	0.50
Min. II	12.76	0.05	0.51	0.45

Acknowledgements:

During this study we have made use of the Astronomical Data Centre SIMBAD (Strasbourg, France)

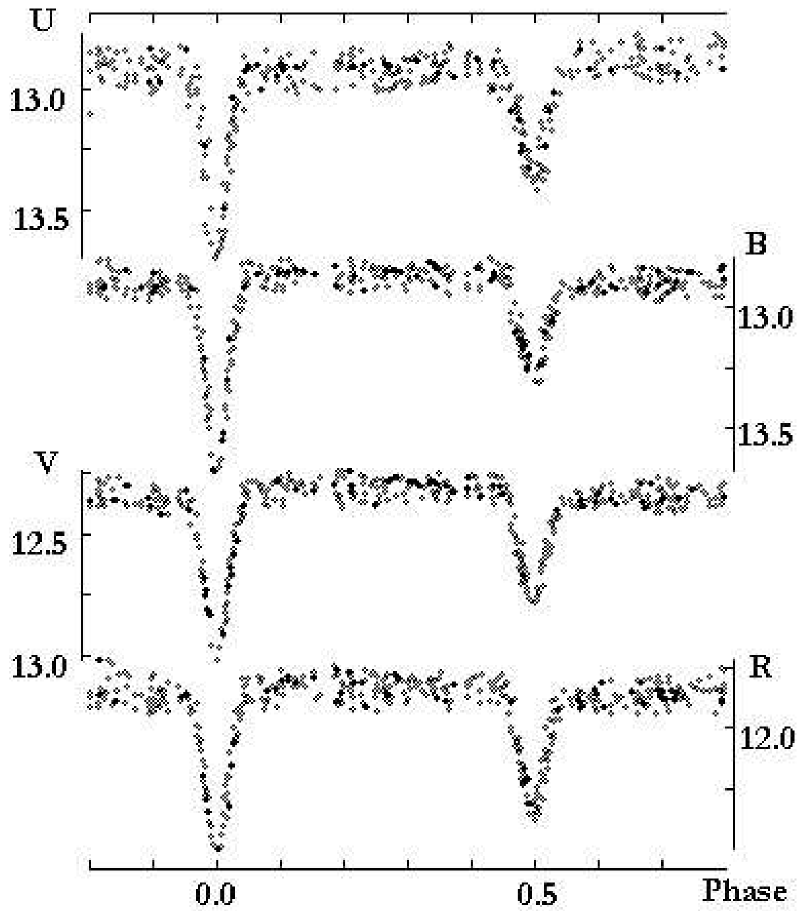

Figure 1. The phased U,B,V,R light curves.

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CCD LIGHT CURVES OF ROTSE1 VARIABLES, XV: GSC 2040:1361 CrB, ROTSE1 GSC 2579:1125 CrB, GSC 2035:175 Ser AND GSC 2580:2086 CrB

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Observatory and telescope:
Private observatory Schüsselacher, Wald, 0.15-m Starfire refractor

Detector:	SBIG ST-7 CCD camera

Method of data reduction:
Standard CCD-frame reduction using AIP4WIN software

Method of minimum determination:
Kwee – van Woerden algorithm

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp./check star(s)
GSC 2040:1361 ROTSE1 J155918.57+275214.9	EW	$15^h59^m18\overset{s}{.}6$	$+27°52'15''$	GSC 2040:1522 / GSC 2040:1563
GSC 2579:1125 ROTSE1 J160014.54+351228.4	EW	$16^h00^m14\overset{s}{.}5$	$+35°12'28''$	GSC 2578:1131 / GSC 2578:1231
GSC 2035:175 ROTSE1 J160153.55+245217.7	EW	$16^h01^m53\overset{s}{.}6$	$+24°52'18''$	GSC 2035:12 / GSC 2035:109
GSC 2580:2086 ROTSE1 J161458.52+301646.1	EW	$16^h14^m58\overset{s}{.}5$	$+30°16'46''$	GSC 2580:2090 / GSC 2580:1995

Ephemeris:

Star name	E 2400000+	P [day]	Source
ROTSE1 J155918.57+275214.9	52365.5044	0.397352	present paper
ROTSE1 J160014.54+351228.4	52409.4467	0.380658	”
ROTSE1 J160153.55+245217.7	52365.4575	0.268729	”
ROTSE1 J161458.52+301646.1	52360.4749	0.308193	”

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
GSC2040:1361 (CrB)	51260.8684	4	p	none		ROTSE1
	51310.7335	3	s	none		ROTSE1
	52360.5379	5	s	none		
	52365.5046	7	p	none		
	52368.4846	4	s	none		
	52395.5049	15	s	none		
	52409.4117	5	s	none		
	52409.6101	9	p	none		
	52419.5700	5	p	none		
GSC2579:1125 (CrB)	51291.8339	4	p	none		ROTSE1
	51305.731	2	s	none		ROTSE1
	52360.5321	8	s	none		
	52365.4792	9	s	none		
	52368.341	6	p	none		
	52368.5276	12	s	none		
	52395.3639	21	p	none		
	52395.5523	24	s	none		
	52409.4459	4	p	none		
	52415.5358	8	p	none		
GSC2035:175 (Ser)	51247.8121	1	p	none		ROTSE1
	51287.7189	7	s	none		ROTSE1
	52359.4103	11	s	none		
	52360.4871	7	s	none		
	52360.6191	11	p	none		
	52365.4569	8	p	none		
	52365.5911	5	s	none		
	52368.4142	18	p	none		
	52368.5471	3	s	none		
	52395.4223	17	s	none		
	52395.554	3	p	none		
	52409.3972	7	s	none		
	52409.5282	6	p	none		
	52415.5762	2	s	none		
GSC2580:2086 (CrB)	51246.8236	10	s	none		ROTSE1
	51280.8741	12	p	none		ROTSE1
	52359.3965	8	s	none		
	52360.4736	3	p	none		
	52360.6273	19	s	none		
	52365.4051	14	p	none		
	52365.5593	8	s	none		
	52368.4874	6	p	none		
	52368.6459	15	s	none		
	52395.4557	12	s	none		
	52409.4776	5	p	none		

Explanation of the remarks in the table:

ROTSE1: Observations of Akerlof et al. (2000).

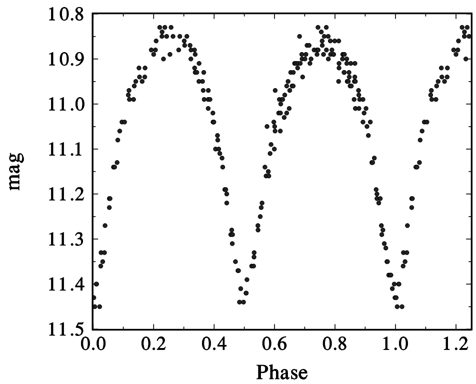

Figure 1. CCD light curve (without filter) of GSC 2040:1361

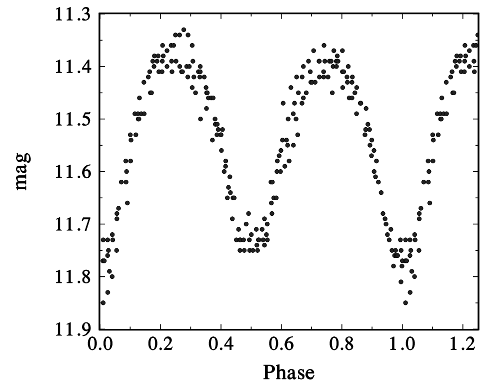

Figure 2. CCD light curve (without filter) of GSC 2579:1125

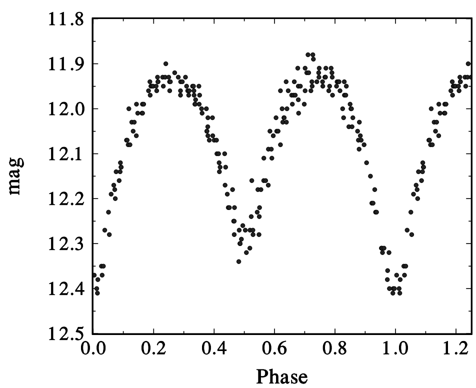

Figure 3. CCD light curve (without filter) of GSC 2035:175

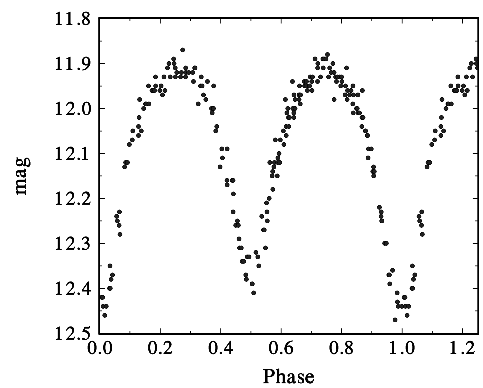

Figure 4. CCD light curve (without filter) of GSC 2580:2086

Remarks:

As a byproduct of the ROTSE1 CCD survey, a large number of new variables have been discovered (Akerlof et al., 2000). In a series of papers, we report unfiltered CCD observations for some of the close binary systems (type EW) in the list of Akerlof et al. (2000). This installment contains information on four variables in the constellations Corona Borealis and Serpens. The four stars were observed with our CCD equipment during 7 nights between JD 2452359 and JD 2452415. A total of 228 CCD frames were measured of GSC 2040:1361, 230 frames of GSC 2579:1125, 226 frames of GSC 2035:175 and 226 frames for GSC 2580:2086. Figures 1 through 4 show our observations folded with the elements given in the table of Ephemeris. These elements of variation are deduced from a linear fit to the normal minima from the ROTSE1 data and the timings of minimum derived from our data given in the table of Times of minima and also in Blättler (2002).

In the case of GSC 2040:1361 we would like to inform future observers that the nearby star GSC 2040:1491 = ROTSE1 J155859.06+274605.2 = IRAS 15569+2754 is itself slowly variable and should therefore not be used as comparison star. During our observing session it varied by 0.25 mag, in good agreement with the data of the ROTSE1 survey.

Availability of the data:
Upon request from diethelm@astro.unibas.ch

Acknowledgements:
This research made use of the SIMBAD data base, operated at CDS, Strasbourg, France

References:

Akerlof, C., Amrose, S., Balsano, R., Bloch, J., Casperson, D., Fletcher, S., Gisler, G., Hills, J., Kehoe, R., Lee, B., Marshall, S., McKay, T., Pawl, A., Schaefer, J., Szymanski, J., Wren, J., 2000, *AJ*, **119**, 1901

Blättler, E., 2002, *BBSAG Bulletin*, **128**

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PHOTOELECTRIC MINIMA OF SELECTED ECLIPSING BINARIES AND MAXIMA OF PULSATING STARS

(BAV MITTEILUNGEN NO. 152)

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In this 46th compilation of BAV results, photoelectric observations obtained in the years 2000 till 2002 are presented on 428 variable stars giving 843 minima and maxima. All moments of minima and maxima are heliocentric. The errors are tabulated in column '±'. The values in column '$O-C$' are determined without incorporation of nonlinear terms. The references are given in the section 'Remarks'. All information about photometers and filters are specified in the column 'Rem'. The observations were made at private observatories. The photoelectric measurements and all the lightcurves with evaluations can be obtained from the office of the BAV for inspection.

Table 1: Eclipsing binaries

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
RT And	51924.2517		WTR	−0.0049		GCVS 85		13)
	52229.2833	.0001	QHL	−0.0041		GCVS 85	-Ir	18) 14)
TT And	52202.4791	.0002	RAT RCR	−0.0615		GCVS 85		1)
UU And	51770.5553	.0015	HSR	+0.0258		GCVS 85		15)
AA And	51770.4167	.0006	AG	−0.0886		GCVS 85	BV	2)
AB And	51807.3991		SIR	−0.0151		GCVS 85	-Ir	8)
	51900.3296	.0010	ATB	−0.0144		GCVS 85		1)
	52209.3200	.0005	WTR	−0.0156		GCVS 85		7)
EP And	52217.5469	.0003	RAT RCR	+0.0595		GCVS 85		1)
	52253.5118	.0002	RAT RCR	+0.0589		GCVS 85		1)
LO And	52114.4799	.0007	AG	−0.0085		GCVS 85	BV	2)
RY Aqr	51768.4542	.0007	KI	−0.0554		GCVS 85	-Ir	1)
ST Aqr	51780.5027	.0008	KI	−0.0302		GCVS 85	-Ir	1)
KO Aql	51834.3809		SIR	+0.0455		GCVS 85	-Ir	8)
LT Aql	51715.5543	.0008	RAT RCR					1)
OO Aql	51780.3608	.0003	KI	+0.0137	s	GCVS 85	-Ir	1)
	52137.3988	.0002	WTR	+0.0192		GCVS 85		7)
	52175.4075	.0002	MZ	+0.0188		GCVS 85	-Ir	11)
V415 Aql	51783.4011	.0014	AG	+0.0017		BAVM 69	BV	2)
V417 Aql	51747.4526	.0006	KI	−0.0462	s	BAVR 3)	-Ir	1)
V609 Aql	51811.3068	.0006	KI	−0.0268		GCVS 85	-Ir	1)
V694 Aql	50670.5153	.0003	FR	+0.0001		BAVM 97		5)
V724 Aql	51780.4169	.0010	AG	−0.0089		BAVM 57	BV	2)
	51807.3295	.0005	KI	−0.0115		BAVM 57	-Ir	1)
GSC 1062.0003 Aql	50749.2947	.0007	QU				-Ir	4)
SS Ari	51571.399	.003	MZ	+0.034	s	GCVS 85		6)
	51827.3712		SIR	+0.0280		GCVS 85	-Ir	8)
	51907.3507	.0006	MZ	+0.0268		GCVS 85	-Ir	6)
	52288.3653	.0003	MZ	+0.0163	s	GCVS 85	-Ir	11)

Table 1: Eclipsing binaries (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
ZZ Aur	51601.4602	.0003	RAT RCR	+0.0123		GCVS 85		1)
	51975.4167	.0002	RAT RCR	+0.0129		GCVS 85		1)
	52337.3478	.0003	WTR	+0.0123		GCVS 85		13)
AH Aur	51603.329 :	.001	AG	+0.099	s	BAVR 6)	V	2)
	51926.4768	.0007	AG	+0.0651	s	BAVR 6)		1)
	51955.3793	.0007	AG	+0.0592		BAVR 6)	BV	2)
AP Aur	51571.3753	.0003	AG	+0.0188		BAVM 67	BV	2)
	51624.3267	.0004	RAT RCR	+0.0189		BAVM 67		1)
	51936.3466	.0002	AG	+0.0249		BAVM 67		1)
	52349.4293	.0011	AG	+0.0306	s	BAVM 67	-Ir	1)
CL Aur	51921.5164	.0002	RAT RCR	+0.0943		GCVS 85		1)
EM Aur	52280.2827	.0013	MON	−0.1223		SAC 63	-Ir	1)
EP Aur	51626.3962	.0002	RAT RCR	+0.0045		GCVS 85		1)
FP Aur	51601.3474	.0012	RAT RCR	−0.0660		GCVS 85		1)
FR Aur	52197.5538	.0004	FR	+1.0129		GCVS 85	-Ir	5)
GX Aur	51955.5649	.0003	RAT RCR	+0.0108		BAVM 69		1)
HL Aur	51625.3465	.0001	RAT RCR	−0.0081		GCVS 85		1)
HU Aur	51602.3754	.0003	RAT RCR	−0.0194		GCVS 85		1)
IY Aur	51901.5157	.0014	AG	−0.1033		GCVS 85	BV	2)
KU Aur	51923.4319	.0001	QU	+0.0291		GCVS 85		4)
	51989.4103	.0007	ATB	+0.0286		GCVS 85		1)
	52278.396	.002	JU	+0.027		GCVS 85		4)
MO Aur	51569.3312	.0009	FR	+0.0798		BAVM 68		5)
	52280.3350	.0008	FR	+0.0808		BAVM 68	-Ir	5)
TU Boo	51679.4028	.0015	HSR	+0.0715	s	GCVS 85		16)
TY Boo	52349.3971	.0003	AG	−0.0112	s	BAVM 68		1)
	52349.5564	.0003	AG	−0.0104		BAVM 68		1)
TZ Boo	52034.535 :	.002	AG	+0.068		BAVM 68		1)
	52053.406 :	.001	AG	+0.069	s	BAVM 68	B	2)
	52053.552 :	.001	AG	+0.067		BAVM 68	B	2)
VW Boo	51654.4786	.0004	KI	−0.0287		BAVR 2)	-Ir	1)
	52051.3982	.0007	KI	−0.0290	s	BAVR 2)	-Ir	1)
XY Boo	51671.4932	.0007	KI	−0.0797	s	GCVS 85	-Ir	1)
	52050.4093	.0006	KI	−0.0475		GCVS 85	-Ir	1)
AC Boo	51704.4914	.0004	QU	+0.0034	s	GCVS 85	V	4)
	52053.4100	.0005	QU	+0.0169	s	GCVS 85	V	14)
CV Boo	52055.4650	.0005	QU	−0.0114	s	BAVR 12)	V	14)
	52080.4521	.0003	MZ	−0.0107		BAVR 12)	-Ir	11)
SS Cam	51349.698	.008	AG	−1.455		GCVS 85	BV	2)
SV Cam	51921.2792	.0001	DIE	+0.0460		GCVS 85		7) 17)
	51921.2792	.0001	DIE	+0.0460		GCVS 85		7)
AW Cam	51841.3537	.0009	DIE	+0.0336		GCVS 85		7)
	51841.3537	.0009	DIE	+0.0336		GCVS 85		7) 17)
TX Cnc	51625.3455	.0005	KI	+0.0272	s	GCVS 85	-Ir	1)
	51983.3407	.0005	KI	+0.0282	s	GCVS 85	-Ir	1)
WW Cnc	52345.3327	.0005	AG	−0.0528		BAVR 1)	-Ir	1)
WX Cnc	51569.4228	.0001	RAT RCR	+0.0091		GCVS 85		1)
	51586.5669	.0002	RAT RCR	+0.0090		GCVS 85		1)
	51640.4480	.0002	RAT RCR	+0.0082		GCVS 85		1)
FF Cnc	51626.3639	.0001	FR	−0.0805		BAVM 65		5)
	51927.3500	.0015	FR	−0.1103	s	BAVM 65		5)
	51956.4827	.0009	AG	−0.0869	s	BAVM 65	BV	2)
RV CVn	52344.4099	.0028	AG				-Ir	1)
	52344.5458	.0020	AG				-Ir	1)
BI CVn	51678.4430	.0005	AG	−0.0606		GCVS 85	BV	2)
XZ CMi	51580.3212	.0001	RAT RCR	−0.0096		GCVS 85		1)
BH CMi	51957.3316	.0019	AG				BV	2)
TV Cas	51586.374	.002	MZ	−0.010		GCVS 85		6)
TW Cas	51902.3718	.0010	QU	−0.0158		GCVS 85	V	4)
	52229.4553	.0010	QHL	−0.0185		GCVS 85	-Ir	18) 14)

Table 1: Eclipsing binaries (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
ZZ Cas	52121.5116	.0002	RAT RCR	+0.0234		GCVS 85		1)
AX Cas	51780.4837	.0002	RAT RCR	−0.0591		GCVS 85		1)
BH Cas	51846.4408	.0012	AG					1)
	51846.6449	.0024	AG					1)
	51925.3842	.0005	AG					1)
	51925.5897	.0006	AG					1)
DZ Cas	51773.544 :	.002	AG	−0.156	s	GCVS 85		1)
EP Cas	52119.4817	.0003	RAT RCR	−0.0353		GCVS 85		1)
GT Cas	51391.5531	.0005	MS	+0.1447		GCVS 85		1)
IL Cas	51925.3016	.0007	QU	−0.0621		GCVS 85	V	4)
	52194.5351	.0040	JU	−0.0648		GCVS 85		4)
IR Cas	52190.4446	.0027	PC	+0.0161		GCVS 85	-Ir	12)
IT Cas	52187.3241	.0009	JU	−0.0980	s	SAC 69		4)
IV Cas	51762.4505	.0020	HSR	−0.0281		GCVS 85		15)
	51899.2443	.0002	RAT RCR	−0.0322		GCVS 85		1)
MM Cas	51943.3416	.0025	HSR	+0.0146		BAVR 1)		10)
MN Cas	52179.4846	.0004	AG	+0.0097		GCVS 85		1)
	52205.3648	.0028	AG	+0.0113	s	GCVS 85		1)
	52224.5429	.0005	AG	+0.0202	s	GCVS 85		1)
MT Cas	51807.3638	.0002	RAT RCR					1)
OX Cas	51768.4928	.0007	AG	+0.0246	s	GCVS 85	BV	2)
	51814.4818	.0019	AG	−0.0094		GCVS 85	BV	2)
PV Cas	51900.4076	.0011	MZ	+0.0030	s	GCVS 85	-Ir	6)
	52188.3351	.0004	MZ	−0.0299		GCVS 85	-Ir	11)
	52188.3355	.0019	JU	−0.0295		GCVS 85		4)
	52195.3379	.0011	JU	−0.0289		GCVS 85		4)
	52209.3406	.0011	MON	−0.0300		GCVS 85	-Ir	1)
	52224.2443	.0010	MON	+0.0030	s	GCVS 85	-Ir	1)
V357 Cas	51773.4276	.0014	AG	+0.0220	s	GCVS 85		1)
	51812.3471	.0010	AG	+0.1434	s	GCVS 85		1)
	52120.5508	.0013	RAT RCR	+0.2445	s	GCVS 85		1)
V359 Cas	51766.4568	.0012	AG	−0.0010	s	BAVM 132		1)
	52122.4144	.0017	AG	−0.0015	s	BAVM 132		1)
V360 Cas	51865.3944	.0003	RAT RCR					1)
V364 Cas	51927.3394	.0005	AG	−0.0199		GCVS 85		1)
V445 Cas	51782.4357	.0025	HSR	−0.0059		BAVM 69		15)
V473 Cas	51811.3969	.0002	RAT RCR	−0.0060		BAVM 115		1)
	51867.4827	.0003	AG	−0.0074		BAVM 115		1)
	52135.4551	.0006	AG	−0.0072		BAVM 115		1)
	52179.4936	.0030	AG	−0.0075		BAVM 115		1)
	52193.4123	.0006	AG	−0.0067	s	BAVM 115		1)
	52193.6155	.0011	AG	−0.0113		BAVM 115		1)
V541 Cas	51966.3993	.0002	AG	+0.3267	s	GCVS 85		1)
V651 Cas	51867.4131	.0003	AG	+0.0008	s	BAVM 55	BV	2)
U Cep	51796.4867		DDH	+0.1153		GCVS 85		4)
WW Cep	52197.5102	.0010	AG	+0.0006		BAVM 71		1)
WZ Cep	51817.4762	.0003	RAT RCR	−0.0317		GCVS 85		1)
CO Cep	51899.3360	.0002	RAT RCR	−0.1681		GCVS 85		1)
CW Cep	51771.4959	.0009	AG	+0.0696	s	GCVS 85	BV	2)
DV Cep	52051.4968	.0002	RTZ	−0.0035		BAVM 47		1)
	52087.5177	.0001	RTZ	−0.0038		BAVM 47		1)
EF Cep	51923.3398	.0002	AG	−0.0076		GCVS 85		1)
	51923.6413	.0002	AG	−0.0092	s	GCVS 85		1)
	51925.4613	.0008	RAT RCR	−0.0074	s	GCVS 85		1)
EG Cep	52042.4944	.0001	RAT RCR	+0.0124		GCVS 85		1)
EK Cep	52197.5560	.0013	AG	+0.0101		GCVS 85	V	1)
GW Cep	51900.3948	.0002	RAT RCR	−0.0171	s	BAVR 4)		1)
	52143.5022	.0002	RAT RCR	−0.0185		BAVR 4)		1)
IO Cep	51782.4792	.0001	RAT RCR	−0.0140		GCVS 85		1)
IP Cep	52198.480 :	.005	AG	−0.009	s	BAVM 132		1)

Table 1: Eclipsing binaries (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
LL Cep	52113.5039	.0002	RAT RCR					1)
MT Cep	52151.5765	.0019	AG					1)
OT Cep	52252.4469	.0004	AG	+0.0024	s	BAVM 142		1)
	52310.4303	.0002	AG	−0.0026		BAVM 142	-Ir	1)
	52347.4848	.0003	AG	−0.0029		BAVM 142	-Ir	1)
PX Cep	51667.4892	.0009	AG					1)
	52039.5699	.0003	RAT RCR					1)
V338 Cep	51812.5523	.0039	AG	+0.0167		GCVS 85	BV	2)
V383 Cep	51812.4137	.0017	AG	+0.0012		BAVM 64	BV	2)
	51827.3700	.0015	AG	+0.0001		BAVM 64	BV	2)
	52043.498 :	.003	AG	−0.006	s	BAVM 64	BV	2)
V489 Cep	51757.4533	.0008	AG	+0.0216	s	BAVM 94		1)
	52043.4866	.0005	AG	+0.0418	s	BAVM 94		1)
TT Cet	51879.3247	.0006	KI	−0.0417	s	GCVS 85	-Ir	1)
VV Cet	51899.2517	.0007	KI	+0.0953		GCVS 85	-Ir	1)
SS Com	51659.4074	.0005	KI	+0.0630	s	BAVR 3)	-Ir	1)
	52002.4600	.0002	RAT RCR	+0.0710	s	BAVR 3)		1)
	52039.4081	.0005	KI	+0.0727		BAVR 3)	-Ir	1)
CC Com	51660.3951	.0003	KI	−0.0093	s	GCVS 85	-Ir	1)
LL Com	52344.4663	.0009	AG				-Ir	1)
TW CrB	51680.3839	.0001	RAT RCR					1)
BO Cyg	51838.4000	.0002	RAT RCR	+0.0596		GCVS 85		1)
	52191.4034	.0010	MZ	+0.0613		GCVS 85	-Ir	11)
CG Cyg	51773.4380	.0018	AG	+0.0422		GCVS 85	BV	2)
CV Cyg	52192.3848	.0009	MZ	−0.0016	s	SAC 68	-Ir	11)
	52195.3317	.0021	ATB	−0.0049	s	SAC 68		1)
DO Cyg	51840.4092	.0002	RAT RCR					1)
GO Cyg	51806.3726	.0007	AG	+0.0591		GCVS 85	BV	2)
	52144.4417	.0009	AG	+0.0614		GCVS 85	BV	2)
KR Cyg	51797.4700	.0005	FR	+0.0016	s	GCVS 85		5)
	51816.4875	.0004	FR	+0.0032		GCVS 85		5)
	51850.2932	.0002	FR	+0.0028		GCVS 85		5)
V345 Cyg	51771.4625	.0006	FR	+0.0005		BAVM 132		5)
	51773.5417	.0006	FR	+0.0042		BAVM 132		5)
	51798.4458	.0007	FR	+0.0018		BAVM 132		5)
	51850.3389	.0006	FR	+0.0064		BAVM 132		5)
V456 Cyg	51770.4468	.0005	AG	+0.0170	s	GCVS 85		1)
V463 Cyg	52113.4616	.0027	JU	+0.0246		SAC 63		4)
	52219.3288	.0004	MZ	+0.0134		SAC 63	-Ir	11)
V483 Cyg	52112.4430	.0019	AG					1)
V488 Cyg	51705.4292	.0002	FR	+0.0964	s	GCVS 85		5)
	51773.5290	.0009	FR	+0.0938		GCVS 85		5)
	51797.3521	.0003	FR	+0.0952	s	GCVS 85		5)
	51798.4747	.0003	FR	+0.0967	s	GCVS 85		5)
	51816.4095	.0002	FR	+0.0951	s	GCVS 85		5)
	51850.3245	.0005	FR	+0.0991		GCVS 85		5)
	51854.2435	.0011	FR	+0.0945		GCVS 85		5)
	52113.4814	.0003	FR	+0.0951	s	GCVS 85	-Ir	5)
	52115.4420	.0010	FR	+0.0939		GCVS 85	-Ir	5)
	52195.3144	.0005	AG	+0.0932	s	GCVS 85		1)
V500 Cyg	52200.3907	.0002	RAT RCR	+0.0759		GCVS 85		1)
V548 Cyg	52150.4147	.0020	JU	+0.0159		GCVS 85		4)
V628 Cyg	52114.4488	.0003	AG	−0.0013	s	BAVM 89		1)
V652 Cyg	51195.4814	.0010	RAT RCR	+1.2575		GCVS 85		1)
V687 Cyg	51682.4473	.0140	HSR	−0.0012		GCVS 85		16)
V700 Cyg	51770.3994	.0003	AG	−0.0225	s	GCVS 85		1)
	51770.5449	.0005	AG	−0.0470		GCVS 85		1)
	52203.2947	.0009	PC	−0.0058	s	GCVS 85	-Ir	12)
V725 Cyg	51393.4990	.0011	FR	+0.1977		GCVS 85		5)
	51459.3544	.0012	FR	+0.2074		GCVS 85		5)

Table 1: Eclipsing binaries (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
V725 Cyg	51816.3936	.0001	FR	+0.2160		GCVS 85		5)
	52050.5230	.0010	FR	+0.2270		GCVS 85		5)
V809 Cyg	51812.4150	.0002	RAT RCR					1)
V828 Cyg	51766.4454	.0009	AG	−0.3064		GCVS 85	BV	2)
	52150.4505	.0008	AG	−0.3799	s	GCVS 85	BV	2)
V859 Cyg	52093.4441	.0004	AG	−0.0319		GCVS 85		1)
V884 Cyg	51806.3311	.0007	RAT RCR					1)
V934 Cyg	51799.4041	.0014	AG	−0.0642	s	GCVS 85		1)
	52080.3843	.0026	AG	−0.0644	s	GCVS 85		1)
V974 Cyg	51786.4057	.0010	FR	−0.1081	s	GCVS 85		5)
V975 Cyg	52112.4772	.0006	FR				-Ir	5)
V1130 Cyg	51840.279 :		RAT RCR					1)
	52136.4685	.0003	AG					1)
V1147 Cyg	52192.3467	.0008	FR				-Ir	5)
V1187 Cyg	51797.4368	.0008	AG	+0.7373		BAVM 73	BV	1)
	52075.4714	.0003	AG	−0.0233		BAVM 73		1)
V1188 Cyg	51146.4794	.0008	RAT RCR					1)
V1191 Cyg	51797.4916	.0005	AG	+0.0137	s	GCVS 85	BV	1)
	52075.4565	.0004	AG	+0.0132	s	GCVS 85		1)
V1196 Cyg	52117.4861	.0007	AG					1)
V1401 Cyg	52225.4629	.0016	AG					1)
V1411 Cyg	52225.3976	.0010	AG	+0.1921		GCVS 85		1)
V1417 Cyg	52225.289 :	.001	AG					1)
	52258.3553	.0004	AG				-Ir	1)
V2021 Cyg	51806.479 :	.001	AG				BV	2)
V2181 Cyg	51705.4678	.0005	QU	+0.0014		BAVR 17)	V	4)
	51705.4702	.0005	FR	+0.0038		BAVR 17)		5)
	51771.4221	.0004	FR	+0.0054		BAVR 17)		5)
	51773.4278	.0014	FR	+0.0039	s	BAVR 17)		5)
	51797.5232	.0014	FR	+0.0130	s	BAVR 17)		5)
	51798.3720	.0006	FR	+0.0017		BAVR 17)		5)
	51799.5214	.0005	FR	+0.0041		BAVR 17)		5)
	51816.4358	.0012	FR	+0.0008	s	BAVR 17)		5)
	51850.2745	.0003	FR	+0.0040	s	BAVR 17)		5)
	51854.2888	.0007	FR	+0.0040	s	BAVR 17)		5)
	52050.4187	.0017	FR	+0.0033	s	BAVR 17)		5)
	52060.4558	.0012	FR	+0.0044		BAVR 17)		5)
	52087.4102	.0005	FR	+0.0052		BAVR 17)		5)
	52113.5022	.0009	FR	+0.0038	s	BAVR 17)	-Ir	5)
	52122.3932	.0008	FR	+0.0059		BAVR 17)	-Ir	5)
	52136.4390	.0010	FR	+0.0014	s	BAVR 17)	-Ir	5)
	52194.3630	.0014	FR	+0.0037	s	BAVR 17)	-Ir	5)
	52209.2675	.0004	FR	−0.0023	s	BAVR 17)	-Ir	5)
	52217.2946	.0008	FR	−0.0039	s	BAVR 1)	-Ir	5)
TY Del	51814.3276	.0008	KI	+0.0453		GCVS 85	-Ir	1)
EX Del	51716.4531	.0002	RAT RCR	−0.0391		GCVS 85		1)
	51762.4565	.0005	KI	−0.0697		GCVS 85	-Ir	1)
GG Del	51799.3452	.0011	KI	−0.0183		GCVS 85	-Ir	1)
	52085.4635	.0003	RAT RCR	−0.0191		GCVS 85		1)
AR Dra	51926.4912	.0001	RAT RCR					1)
	51968.3931	.0003	RAT RCR					1)
AU Dra	51833.3041	.0003	RAT RCR					1)
	52039.4092	.0002	RAT RCR					1)
AX Dra	51580.4989	.0001	RAT RCR	−0.0037		BAVR 1)		1)
BV Dra	51636.3423	.0010	HSR					4)
BX Dra	52000.4709	.0005	AG	+0.0040		BAVM 82		1)
	52040.4257	.0004	AG	+0.0060		BAVM 82		1)
CV Dra	51816.3749	.0010	AG	−0.0055		BAVM 69	V	2)
EF Dra	51680.4526	.0005	AG	+0.0172	s	BAVM 63	BV	2)
S Equ	51812.41 :		SIR	+0.06		GCVS 85	-Ir	8)

Table 1: Eclipsing binaries (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
UX Eri	51901.3588	.0006	KI	+0.1049	s	GCVS 85	-Ir	1)
YY Eri	51567.3144	.0004	KI	+0.0821		GCVS 85	-Ir	1)
	51900.3883	.0005	KI	−0.0727	s	GCVS 85	-Ir	1)
BL Eri	51873.4601	.0004	KI	+0.0981		GCVS 85	-Ir	1)
CD Eri	51923.2552	.0008	KI				-Ir	1)
WW Gem	51640.3948	.0035	ATB	+0.0292		GCVS 85		1)
YY Gem	51641.3893	.0021	ATB	−0.0082		GCVS 85		1)
	51924.3524		BRN STK	−0.0082	s	GCVS 85		4)
	51926.3881		BRN STK	−0.0083		GCVS 85		4)
AI Gem	51899.4945	.0003	FR					5)
BD Gem	51901.4559	.0004	KI	−0.0232		GCVS 85	-Ir	1)
EY Gem	52280.4035	.0018	AG	−0.1996		GCVS 85		1)
FG Gem	51956.3847	.0003	KI	−0.0274		GCVS 85	-Ir	1)
KQ Gem	52280.5785	.0010	AG					1)
KV Gem	52280.4100	.0005	AG	−0.0179	s	GCVS 85		1)
	52280.5895	.0007	AG	+0.0523		GCVS 85		1)
TT Her	51712.4561	.0004	KI	+0.0267		GCVS 85	-Ir	1)
AK Her	51713.4988	.0007	KI	+0.0070	s	GCVS 85	-Ir	1)
	51996.5479		SIR	+0.0062		GCVS 85	-Ir	8)
CC Her	51669.5061	.0001	RAT RCR	+0.1100		GCVS 85		1)
CT Her	51708.4701	.0006	KI	−0.0011		GCVS 85	-Ir	1)
FN Her	51661.4615	.0040	HSR	+0.1045		GCVS 85		16)
HS Her	51758.4671	.0018	AG	−0.0112	s	GCVS 85	V	2)
	51767.4665	.0006	AG	−0.0177		GCVS 85	V	2)
LT Her	51703.4593	.0010	KI	−0.0066		BAVM 69	-Ir	1)
MT Her	51770.4050	.0006	KI	+0.0122	s	GCVS 85	-Ir	1)
V342 Her	52053.4754	.0003	AG	+0.0056		GCVS 85		1)
	52119.499 :	.002	AG	+0.020	s	GCVS 85		1)
V450 Her	51811.422	.008	ATB	+0.184	s	GCVS 85		1)
	52040.4882	.0019	AG	+0.1551	s	GCVS 85	BV	2)
	52188.3700	.0011	ATB	+0.1748	s	GCVS 85		1)
V502 Her	51677.4556	.0003	RAT RCR					1)
	52050.4270	.0002	RAT RCR					1)
	52116.5266	.0002	RAT RCR					1)
V728 Her	52032.4540	.0007	AG	+0.0245	s	BAVM 51	BV	2)
V733 Her	52117.5066	.0002	RAT RCR					1)
V829 Her	51679.4553	.0006	AG				BV	2)
V878 Her	52118.4404	.0021	AG				BV	2)
TY Hya	52344.3550	.0006	AG					1)
WY Hya	51601.4316	.0004	KI	+0.0180	s	GCVS 85	-Ir	1)
	51954.4243	.0005	KI	+0.0195	s	GCVS 85	-Ir	1)
AV Hya	51602.3295	.0005	AG	−0.0549		GCVS 85	BV	2)
	51644.3564	.0009	KI	−0.0575	s	GCVS 85	-Ir	1)
	52338.3477	.0005	AG	−0.0652		GCVS 85		1)
EU Hya	51968.3015	.0003	RAT RCR	−0.0198		GCVS 85		1)
FG Hya	51955.4675	.0007	KI	−0.0562	s	GCVS 85	-Ir	1)
	52307.3941	.0011	AG	−0.0573		GCVS 85	-Ir	1)
SW Lac	51924.3026	.0012	MZ	−0.0704	s	GCVS 85	-Ir	6)
ZZ Lac	50677.3988	.0006	FR					5)
AU Lac	51833.4706	.0001	RAT RCR					1)
AW Lac	52146.4850	.0007	AG	+0.0224		BAVR 5)		1)
	52150.4835	.0012	AG	+0.0209	s	BAVR 5)		1)
CO Lac	52121.4712	.0007	MON	−0.0027		SAC 72	-Ir	1)
	52148.4892	.0010	JU	+0.0266	s	SAC 72		4)
	52151.5723	.0072	AG	+0.0253	s	SAC 72		1)
	52202.4647	.0009	JU	+0.0248	s	SAC 72		4)
DG Lac	52150.4244	.0005	AG	−0.1898		GCVS 85		1)
	52267.3713	.0006	AG	−0.1892		GCVS 85	-Ir	1)
EP Lac	52267.3933	.0013	AG	−0.3090		GCVS 85	-Ir	1)
HR Lac	52225.4627	.0009	AG					1)

Table 1: Eclipsing binaries (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
HR Lac	52258.2885	.0009	AG				-Ir	1)
HX Lac	52144.596 :	.001	AG					1)
	52196.5654	.0018	AG					1)
IU Lac	51771.4361	.0012	AG					1)
	51901.2891	.0003	AG					1)
	52083.4694	.0007	AG					1)
	52084.4404	.0003	AG					1)
	52113.5127	.0004	AG					1)
IZ Lac	51780.4439	.0006	AG					1)
	51786.4459	.0045	AG					1)
	51814.40	.01	AG					1)
	51816.3977	.0018	AG					1)
	52133.563 :	.003	AG					1)
LU Lac	51786.4931	.0019	AG					1)
	52123.391 :	.003	AG					1)
	52123.5425	.0006	AG					1)
LZ Lac	52150.4223	.0011	AG					1)
MZ Lac	52150.5162	.0024	AG	+0.1343		GCVS 85		1)
	52267.3937	.0006	AG	+0.1364		GCVS 85	-Ir	1)
NR Lac	52196.5329	.0021	AG					1)
NS Lac	52196.4340	.0016	AG					1)
NW Lac	52151.3789	.0028	AG					1)
	52278.2992	.0003	AG					1)
PP Lac	51785.3505	.0002	RAT RCR	−0.0326		GCVS 85		1)
	52148.3999	.0027	AG	−0.0357		GCVS 85		1)
V342 Lac	51780.3679	.0017	AG				V	2)
	51816.4448	.0026	AG					1)
	51817.4985	.0006	AG					1)
	52085.4771	.0010	AG					1)
	52113.4995	.0015	AG					1)
	52134.5136	.0011	AG					1)
	52194.4178	.0018	AG					1)
	52228.3955	.0015	AG					1)
V364 Lac	51796.4294	.0007	FR	−0.0491	s	BAVR 10)		5)
	51807.3494	.0006	FR	−0.0095		BAVR 10)		5)
	52123.4761	.0013	FR	+0.0001		BAVR 10)	-Ir	5)
	52193.4199	.0017	FR	−0.0429	s	BAVR 10)	-Ir	5)
GSC 3969.2430 Lac	51901.2644	.0004	AG	+0.0046		BAVM 135		1)
	52083.5210	.0008	AG	+0.0138		BAVM 135		1)
	52084.4474	.0004	AG	+0.0135		BAVM 135		1)
	52113.4867	.0010	AG	+0.0167		BAVM 135		1)
	52134.4929	.0018	AG	+0.0182		BAVM 135		1)
	52194.4180	.0005	AG	+0.0178		BAVM 135		1)
	52194.5744	.0056	AG	+0.0198	s	BAVM 135		1)
	52228.4033	.0014	AG	+0.0248		BAVM 135		1)
	52228.5577	.0005	AG	+0.0247	s	BAVM 135		1)
UV Leo	51596.4036	.0003	DIE	−0.0015		BAVM 77		7)
	51974.4601	.0003	KI	+0.0006		BAVM 77	-Ir	1)
UX Leo	52011.3698	.0004	KI	+0.0236		BAVM 68	-Ir	1)
XY Leo	51937.4320	.0007	AG	+0.0126		GCVS 85	BV	2)
	51937.5741	.0010	AG	+0.0126	s	GCVS 85	V	2)
	52337.5823	.0005	AG	+0.0124	s	GCVS 85	-Ir	1)
XZ Leo	51937.5703	.0006	AG	+0.0305		GCVS 85	BV	2)
	51950.4944	.0004	KI	+0.0296	s	GCVS 85	-Ir	1)
	52337.5143	.0004	AG	+0.0317		GCVS 85	-Ir	1)
AL Leo	51610.4259	.0004	AG	+0.0079		BAVM 53	BV	2)
BL Leo	51965.4031	.0003	RAT RCR					1)
T LMi	51974.6151	.0020	HSR	−0.0624		GCVS 85		10)
RT LMi	51602.4688	.0003	AG	−0.0024		GCVS 85	BV	2)
	51641.4637	.0003	RAT RCR	+0.0011		GCVS 85		1)

Table 1: Eclipsing binaries (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
RT LMi	52338.4296	.0002	AG	−0.0056		GCVS 85	-Ir	1)
RY Lyn	51956.5341	.0002	RAT RCR	−0.0331		GCVS 85		1)
SW Lyn	51586.3124	.0001	DIE	+0.0252		GCVS 85		7)
BG Lyn	51936.5260	.0006	AG					1)
	51956.3272	.0014	AG				BV	2)
TZ Lyr	52059.4851	.0001	RAT RCR	+0.0041		GCVS 85		1)
UZ Lyr	52189.3064	.0009	WTR	−0.0146		GCVS 85		7)
BV Lyr	52224.2889	.0003	RAT RCR					1)
EW Lyr	51673.5434	.0015	HSR	+0.2427		GCVS 85		16)
	51714.4662	.0001	RAT RCR	+0.2423		GCVS 85		1)
FG Lyr	52133.4841	.0008	RAT RCR					1)
NV Lyr	52147.4720	.0009	AG					1)
NY Lyr	51680.5720	.0015	HSR	+0.0740		GCVS 85		16)
	52147.3827	.0017	AG	+0.0825		GCVS 85		1)
QU Lyr	51695.4166	.0040	HSR	−0.0015		GCVS 85		16)
	51758.4032	.0004	AG	−0.0013	s	GCVS 85		1)
	52156.5014	.0015	AG	−0.0015		GCVS 85		1)
	52199.3073	.0005	RAT RCR	−0.0018		GCVS 85		1)
V400 Lyr	52095.4715	.0003	AG					1)
	52096.4843	.0005	AG					1)
	52100.5378	.0004	AG					1)
	52121.4453	.0002	AG					1)
	52121.5727	.0008	AG					1)
	52129.4300	.0003	AG					1)
	52136.3983	.0014	AG					1)
	52136.5249	.0010	AG					1)
	52140.451 :	.005	AG					1)
	52140.580 :	.005	AG					1)
	52156.4186	.0052	AG					1)
V401 Lyr	52096.5163	.0006	AG					1)
	52129.3928	.0004	AG					1)
	52156.357	.006	AG					1)
V404 Lyr	51678.5454	.0007	AG	+0.0007	s	BAVM 133		1)
	51816.3258	.0002	RAT RCR	−0.0016		BAVM 133		1)
	52095.5484	.0008	AG	+0.0009		BAVM 133		1)
	52121.4978	.0012	AG	+0.0019	s	BAVM 133		1)
	52136.4824	.0010	AG	+0.0022		BAVM 133		1)
	52140.509 :	.003	AG	+0.009	s	BAVM 133		1)
V406 Lyr	51680.4347	.0004	AG	−0.0163		BAVM 72		1)
AQ Mon	51600.3048	.0005	KI	−0.0726		GCVS 85	-Ir	1)
IX Mon	51927.2956	.0005	RAT RCR					1)
V454 Mon	51586.4783	.0018	MS					1)
V496 Mon	51950.3781	.0007	KI	−0.0223	s	GCVS 85	-Ir	1)
V514 Mon	51899.5002	.0013	KI	−0.0411	s	GCVS 85	-Ir	1)
V532 Mon	51927.3528	.0003	MS FR	+0.0543		GCVS 85		8) 17)
V714 Mon	51580.4984	.0004	FR					5)
	51923.4580	.0004	KI				-Ir	1)
V508 Oph	51687.3838	.0010	HSR	+0.0028		GCVS 85		16)
V735 Oph	51680.4248	.0035	HSR					16)
V839 Oph	51787.3462	.0004	KI	−0.0530		GCVS 85	-Ir	1)
V981 Oph	51671.4615	.0005	RAT RCR					1)
EF Ori	51176.4831	.0026	FR					5)
	52279.3351	.0005	FR				-Ir	5)
ER Ori	51924.3444	.0005	KI	+0.0262		GCVS 85	-Ir	1)
ET Ori	51569.3191	.0005	KI	+0.0024		GCVS 85	-Ir	1)
FT Ori	51602.3560	.0004	QU	+0.6469	s	GCVS 85	V	4)
FZ Ori	51954.3310	.0006	KI	−0.0777	s	GCVS 85	-Ir	1)
	51965.3337	.0014	MZ	−0.0586		GCVS 85	-Ir	11)
GU Ori	51568.2640	.0001	FR					5)
	51568.4986	.0007	FR					5)

Table 1: Eclipsing binaries (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
GU Ori	51571.3231	.0006	FR					5)
	51571.5555	.0035	FR					5)
	52279.4571	.0005	FR				-Ir	5)
V343 Ori	51938.3663	.0015	AG	+0.1465		GCVS 85	BV	2)
	51955.3581	.0006	KI	+0.1467		GCVS 85	-Ir	1)
V392 Ori	51925.4501	.0006	KI	+0.0017		GCVS 85	-Ir	1)
GSC 140.1831 Ori	51580.3492	.0008	MS					1)
U Peg	51821.4071	.0006	KI	−0.0829		GCVS 87	-Ir	1)
VW Peg	52141.4447	.0006	AG	+0.0011		BAVM 129	V	1)
AT Peg	52276.2631	.0020	MZ	+0.0145		GCVS 87	-Ir	11)
AY Peg	52118.4544	.0005	AG					1)
BB Peg	51770.5212	.0003	KI	+0.0008		GCVS 87	-Ir	1)
BO Peg	52151.4263	.0012	PC	−0.0222		GCVS 87	-Ir	12)
BX Peg	52137.3969	.0021	AG	−0.0581		GCVS 87		1)
	52137.5365	.0027	AG	−0.0587	s	GCVS 87		1)
BY Peg	52137.5063	.0014	AG					1)
CC Peg	49562.4197	.0010	AG	+0.0053	s	BAVM 133		1)
	49574.5242	.0004	AG	−0.0023	s	BAVM 133		1)
	49581.491 :	.003	AG	+0.000		BAVM 133		1)
	49587.546 :	.004	AG	−0.001		BAVM 133		1)
	49618.4290	.0006	AG	−0.0037		BAVM 133		1)
	50671.5777	.0005	AG	+0.0012		BAVM 133		1)
	51390.4271	.0006	AG	−0.0003		BAVM 133		1)
	51413.4407	.0007	AG	+0.0004		BAVM 133		1)
	52137.4438	.0019	AG	−0.2978		BAVM 133		1)
CW Peg	52137.436	.005	AG	+0.042	s	GCVS 87		1)
DI Peg	51807.4721	.0012	KI	−0.0144	s	GCVS 87	-Ir	1)
	51818.5020	.0007	ATB	−0.0177		GCVS 87		1)
	51868.3321	.0001	DIE	−0.0148		GCVS 87		7) 17)
	51868.3321	.0001	DIE	−0.0148		GCVS 87		7)
	52278.3363	.0002	MZ	−0.0171		GCVS 87	-Ir	11)
EY Peg	51807.4725	.0005	AG					1)
RT Per	51924.4592	.0001	RAT RCR	+0.0461		GCVS 87		1)
RV Per	51900.5633	.0001	RAT RCR	−0.0063		GCVS 87		1)
BP Per	52278.3303	.0007	AG	−0.0180		GCVS 87	-Ir	1)
DK Per	51924.2951	.0001	RAT RCR					1)
	52279.3514	.0014	AG					1)
DZ Per	52279.6642	.0004	AG					1)
IK Per	51923.3535	.0009	AG	−0.1032		GCVS 87	BV	2)
IM Per	51586.4521	.0005	RAT RCR	+0.0710		GCVS 87		1)
IQ Per	52225.3320	.0010	MON	−0.0016		GCVS 87	-Ir	1)
IU Per	51906.2983	.0007	DIE	+0.0130		GCVS 87		7)
	52622.2991	.0007	DIE	−0.0308	s	GCVS 87		7) 17)
KL Per	51924.4363	.0002	AG					1)
	52253.4526	.0004	AG				-Ir	1)
PS Per	51899.5900	.0003	RAT RCR					1)
QU Per	51926.3574	.0015	RAT RCR					1)
V427 Per	52258.3152	.0002	AG					1)
V432 Per	51901.2965	.0017	AG	−0.0139		BAVM 61	V	2)
V511 Per	51799.5604	.0009	AG				V	2)
UV Psc	51821.5362	.0004	KI	−0.0104		GCVS 87	-Ir	1)
VZ Psc	51825.4071	.0011	KI	−0.0200	s	GCVS 87	-Ir	1)
NSV 361 Psc	51140.3614	.0005	KI				-Ir	1)
	51495.3511	.0006	KI				-Ir	1)
	51840.4126	.0006	KI				-Ir	1)
CU Sge	51769.4176	.0005	KI	+0.0163		GCVS 87	-Ir	1)
DM Sge	51709.4885	.0002	RAT RCR					1)
AS Ser	51660.4476	.0002	RAT RCR	−0.0143		GCVS 87		1)
AU Ser	52041.5684	.0020	PC				-Ir	12)
CC Ser	52049.4356	.0005	AG	−0.0214		GCVS 87	BV	2)

Table 1: Eclipsing binaries (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
V335 Ser	51708.4494	.0020	QU	−0.0153		BAVM 110	V	4)
Y Sex	51600.4438	.0007	KI	+0.0166	s	BAVR 1)	-Ir	1)
	51971.3610	.0005	RAT RCR	+0.0204		BAVR 1)		1)
RZ Tau	51586.3220	.0003	KI	+0.0325		GCVS 87	-Ir	1)
	51922.3973	.0003	KI	+0.0348	s	GCVS 87	-Ir	1)
AH Tau	51955.4131	.0002	AG					1)
	52229.5353	.0007	AG					1)
AL Tau	51570.5265	.0005	QU				-Ir	4)
	51839.4881	.0010	QU				V	4)
	51840.4204	.0004	QU				V	4)
CR Tau	51602.3741	.0003	AG	+0.0010		BAVM 123		1)
	51985.3708	.0003	AG	+0.0010		BAVM 123		1)
CU Tau	51600.330 :	.004	MZ	−0.057		GCVS 87		6)
	51780.6152	.0020	HSR	+0.0885		GCVS 87		15)
	51955.3230	.0004	AG	+0.0150		GCVS 87		1)
	52229.4500	.0014	AG	+0.0157		GCVS 87		1)
	52229.6571	.0006	AG	+0.0167	s	GCVS 87		1)
	52304.3257	.0005	AG	+0.0734	s	GCVS 87	-Ir	1)
EN Tau	51558.4041	.0005	QU	−0.0040		GCVS 87	-Ir	4)
	51610.4405	.0004	QU	−0.0068		GCVS 87	V	4)
	51952.4133	.0002	AG	−0.0060		GCVS 87		1)
	52253.5030	.0019	JU	−0.0004		GCVS 87		4)
	52258.4565	.0010	MON	−0.0030		GCVS 87	-Ir	1)
EQ Tau	51899.3656	.0004	KI	−0.0246		GCVS 87	-Ir	1)
	52225.3522	.0004	FR	−0.0258		GCVS 87	-Ir	5)
	52225.5235	.0002	FR	−0.0252	s	GCVS 87	-Ir	5)
	52252.3180	.0003	FR	−0.0265		GCVS 87	-Ir	5)
GR Tau	51885.3014	.0011	DIE	−0.0266		BAVR 5)		7) 17)
	51885.3014	.0011	DIE	−0.0266		BAVR 5)		7)
	51900.3453	.0012	DIE	−0.0275		BAVR 5)		7)
	51900.3453	.0012	DIE	−0.0275		BAVR 5)		7) 17)
	51924.4202	.0010	QU	−0.0244		BAVR 5)	V	4)
	51925.2819	.0002	DIE	−0.0224		BAVR 5)		7)
	51925.2819	.0002	DIE	−0.0224		BAVR 5)		7) 17)
	52308.2767	.0004	WTR	−0.0262		BAVR 5)		13)
X Tri	51899.3675	.0004	QU	−0.0420		GCVS 87	V	4)
	52202.4818	.0004	MON	−0.0466		GCVS 87	-Ir	1)
	52278.2600	.0004	WTR	−0.0482		GCVS 87		7)
W UMa	51955.3434	.0012	JU	−0.0378		GCVS 87		4)
TY UMa	51927.5101	.0001	RAT RCR	−0.0107		GCVS 87		1)
	52002.4983	.0031	PC	−0.0074	s	GCVS 87	-Ir	12)
UX UMa	51966.4360	.0002	RAT RCR	+0.0014		GCVS 87		1)
UY UMa	51671.4867	.0003	AG	+0.0679		GCVS 87		1)
	51956.5095	.0004	AG	+0.0705		GCVS 87		1)
	52041.4825	.0064	PC	+0.0639		GCVS 87	-Ir	12)
	52337.4173	.0003	AG	+0.0741		GCVS 87		1)
	52337.6079	.0002	AG	+0.0767	s	GCVS 87		1)
VV UMa	51556.2793	.0005	DIE	−0.0550		GCVS 87		7)
	51578.2752	.0003	DIE	−0.0552		GCVS 87		7)
AA UMa	52032.4033	.0005	RAT RCR	+0.0186		GCVS 87		1)
AH Vir	51996.3987		SIR	−0.0799		GCVS 87	-Ir	8)
	52021.4684		SIR	−0.0727	s	GCVS 87	-Ir	8)
	52039.3993		SIR	−0.0728	s	GCVS 87	-Ir	8)
AW Vir	51685.4131	.0003	KI	+0.0145	s	GCVS 87	-Ir	1)
	52042.4167	.0003	KI	+0.0122		GCVS 87	-Ir	1)
AZ Vir	51678.4216	.0006	KI	−0.0169	s	GCVS 87	-Ir	1)
	52038.3964	.0003	KI	−0.0224		GCVS 87	-Ir	1)
BH Vir	52041.3814	.0003	KI	−0.0048		GCVS 87	-Ir	1)
HW Vir	51616.4884	.0002	QU				V	4)
	51669.3575	.0003	HSR					16)

Table 1: Eclipsing binaries (cont.)

Variable	Min JD 24...	±	Obs	$O-C$		Fil	Rem
HW Vir	51674.3814	.0002	KI			-Ir	1)
	52001.3711	.0002	AG			V	2)
	52001.4292	.0001	AG			V	2)
	52001.4878	.0004	AG			V	2)
	52001.5460	.0001	AG			V	2)
	52001.6041	.0002	AG			V	2)
Z Vul	51770.5092		DDH	−0.0013	GCVS 87		4)
AB Vul	52073.4467	.0002	AG				1)
AY Vul	51705.4905	.0020	HSR	−0.0251	GCVS 87		16)
BK Vul	52137.4143	.0008	AG	+0.0790	GCVS 87		1)
ER Vul	52141.424	.003	AG			V	1)
HI Vul	52094.4834	.0010	AG	−0.0514	GCVS 87		1)

Table 2: Pulsating stars

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
SW And	51917.4008	.0010	MZ	−0.0211	BAVM 78	-Ir	6)
	52225.2199	.0010	MON	−0.0195	BAVM 78	-Ir	1)
XX And	51900.4951	.0042	ATB	+0.1969	GCVS 85		1)
	52190.3222	.0017	JU	+0.2024	GCVS 85		4)
CI And	51879.5134	.0028	ATB				1)
GP And	51768.528 :		DDH	+0.009	GCVS 85		4)
	51770.4086	.0007	HSR	+0.0013	GCVS 85		15)
	51811.4026		SIR	+0.0016	GCVS 85	-Ir	9)
	51882.3765	.0013	MZ	+0.0036	GCVS 85	-Ir	6)
	51882.458	.003	MZ	+0.007	GCVS 85	-Ir	6)
	51900.2346	.0008	KI	+0.0008	GCVS 85	-Ir	1)
	52257.2963	.0004	MZ	+0.0004	GCVS 85	-Ir	11)
	52257.3754	.0004	MZ	+0.0008	GCVS 85	-Ir	11)
	52257.4536	.0004	MZ	+0.0003	GCVS 85	-Ir	11)
OV And	52267.2017	.0011	MZ	−0.0139	MVS11,133	-Ir	11) red
SW Aqr	51840.293	.001	MZ	−0.012	GCVS 85	-Ir	6)
	51840.3019	.0028	KI	−0.0029	GCVS 85	-Ir	1)
SX Aqr	51798.3798	.0012	KI	+0.0083	BAVR 11)	-Ir	1)
BR Aqr	51798.5131	.0009	KI	−0.1150	GCVS 85	-Ir	1)
CP Aqr	51821.3122	.0005	KI	−0.0823	GCVS 85	-Ir	1)
CY Aqr	51747.5215		DDH	+0.0125	GCVS 85		4)
	51855.376 :	.002	MZ	+0.012	GCVS 85	-Ir	6)
	51873.323 :	.001	MZ	+0.014	GCVS 85	-Ir	6)
	51873.383 :	.001	MZ	+0.013	GCVS 85	-Ir	6)
	51887.2366	.0004	KI	+0.0109	GCVS 85	-Ir	1)
	52199.4480	.0008	MZ	+0.0113	GCVS 85	-Ir	11)
	52253.2842	.0005	MZ	+0.0116	GCVS 85	-Ir	11)
HH Aqr	52189.375	.003	AG				1)
X Ari	52225.4087	.0010	MON	+0.0184	BAVR 15)	-Ir	1)
RV Ari	51922.2578	.0007	KI	+0.0098	GCVS 85	-Ir	1)
	52224.4520	.0010	MON	+0.0028	GCVS 85	-Ir	1)
	52288.4257	.0007	MZ	−0.0026	GCVS 85	-Ir	11)
	52322.3252	.0002	MZ	−0.0019	GCVS 85	-Ir	11)
TZ Aur	51952.3952		WTR	+0.0124	GCVS 85		13)
	52279.4415	.0008	MON	+0.0104	GCVS 85	-Ir	1)
RS Boo	52042.4080	.0020	MZ	+0.0084	BAVR 7)	-Ir	11)
	52042.4117		WTR	+0.0121	BAVR 7)		13)
SZ Boo	52056.435	.005	PS				3)
TW Boo	52053.3816		WTR	−0.0142	SAC 72		13)
	52054.4477	.0006	MZ	−0.0127	SAC 72	-Ir	11)
UU Boo	52095.4957	.0010	MZ	+0.1345	GCVS 85	-Ir	11)
XX Boo	51975.6294	.0070	HSR	+0.0194	GCVS 85		10)

Table 2: Pulsating stars Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
YZ Boo	51640.4443	.0010	HSR	+0.0026	GCVS 85		16)
	51660.4299	.0010	HSR	+0.0026	GCVS 85		16)
	51810.3221	.0014	ATB	+0.0030	GCVS 85		1)
	52042.4458	.0015	MON	+0.0025	GCVS 85		1)
	52055.4573	.0014	MON	+0.0026	GCVS 85		1)
	52055.4579	.0015	JU	+0.0032	GCVS 85		4)
	52055.5609	.0014	MON	+0.0021	GCVS 85		1)
	52081.4819	.0020	MZ	+0.0042	GCVS 85	-Ir	11)
CM Boo	52094.489 :	.004	MZ	−0.052	GCVS 85	-Ir	11)
CQ Boo	52041.413 :	.001	MZ	+0.000	BAVR 15)	-Ir	11)
RW Cnc	51974.6204	.0020	HSR	+0.1723	GCVS 85		10)
	52345.625	.002	AG	+0.176	GCVS 85	-Ir	1)
SS Cnc	50841.3022	.0016	FR	+0.0478	GCVS 85		5)
	51901.4380	.0010	QU	+0.0464	GCVS 85	V	4)
	52252.6090	.0016	PC	+0.0424	GCVS 85	-Ir	12)
	52258.4900	.0010	FR	+0.0460	GCVS 85	-Ir	5)
AQ Cnc	51910.3865	.0010	QU	−0.0622	GCVS 85	V	4)
	51956.4631	.0008	KI	−0.0613	GCVS 85	-Ir	1)
W CVn	51956.5355		SIR	−0.0135	SAC 70	-Ir	9)
SV CVn	51975.5592	.0065	HSR				10)
UV CVn	51920.7452	.0045	HSR	+0.0463	GCVS 85		10)
VW CVn	51927.571 :	.005	AG	+0.026	BAVR 14)		1)
	52278.620	.004	AG	+0.046	BAVR 14)		1)
	52344.481	.004	AG	+0.036	BAVR 14)	-Ir	1)
X CMi	51956.457	.005	PS	+0.018	BAVR 9)		3)
AD CMi	52306.405 :	.000	MZ	+0.010	GCVS 85	-Ir	11)
GM Cas	51348.373		BRN STK				4)
PS Cas	51867.628	.005	AG	+0.176	GCVS 85		1)
	52179.522	.005	AG	+0.185	GCVS 85		1)
	52183.515	.005	AG	+0.185	GCVS 85		1)
V470 Cas	51867.515	.002	AG	+0.146	BAVM 87		1)
AQ Cep	52279.5344	.0043	PC			-Ir	12)
EL Cep	52197.608	.007	AG				1)
	52198.441	.007	AG				1)
RZ Cet	51926.2636	.0011	KI	−0.0814	GCVS 85	-Ir	1)
S Com	52000.401	.003	PS	+0.268	SAC 72		3)
Z Com	52000.587	.002	PS				3)
RY Com	51974.4992	.0035	HSR	+0.0209	GCVS 85		10)
	51990.4398	.0035	HSR	+0.0171	GCVS 85		10)
BS Com	51974.5822	.0025	HSR				10)
RV CrB	51975.5559	.0060	HSR	+0.1499	GCVS 85		10)
	52060.4327	.0015	QU	+0.1461	GCVS 85	V	14)
	52120.4436	.0030	MZ	+0.1437	GCVS 85	-Ir	11)
SZ CrB	51679.5874	.0035	HSR	−0.1704	GCVS 85		16)
	51975.6852	.0014	HSR	−0.1611	GCVS 85		10)
Antipin V23 CrB	51615.593	.005	PS				3)
UY Cyg	51830.404	.007	ATB	+0.047	GCVS 85		1)
XX Cyg	52084.4457	.0010	JU	+0.0015	GCVS 85		4)
	52089.4355	.0012	JU	+0.0012	GCVS 85		4)
	52090.3802	.0015	MON	+0.0019	GCVS 85		1)
	52090.5160	.0015	MON	+0.0029	GCVS 85		1)
	52117.4879	.0008	MON	+0.0017	GCVS 85	-Ir	1)
DM Cyg	52201.4444	.0035	ATB	+0.0458	GCVS 85		1)
V939 Cyg	52049.392	.005	AG	−0.043	BAVM 92		1)
BV Del	51768.573	.007	PS	+0.031	GCVS 85		3)
DX Del	51670.5473	.0025	HSR	+0.0486	GCVS 85		16)
	51810.4424	.0028	ATB	+0.0491	GCVS 85		1)
	51812.3308	.0009	KI	+0.0471	GCVS 85	-Ir	1)
VZ Dra	52143.4207	.0023	JU	−0.0958	GCVS 85		4)
	52144.3889	.0035	JU	−0.0907	GCVS 85		4)

Table 2: Pulsating stars Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
VZ Dra	52217.2556	.0013	MZ	−0.0979	GCVS 85	-Ir	11) red
DD Dra	51273.6228	.0031	HSR	−0.1184	BAVR 16)		4)
	52121.413	.003	AG	−0.030	BAVR 16)	BV	2)
	52137.410	.002	AG	−0.046	BAVR 16)	BV	2)
RT Equ	52146.551	.007	PS	+0.123	GCVS 85		3)
RR Gem	51925.4070	.0008	MZ	+0.1373	GCVS 85	-Ir	6)
	52224.5756	.0010	MON	+0.1310	GCVS 85	-Ir	1)
SZ Gem	51900.5179	.0006	KI	−0.0397	GCVS 85	-Ir	1)
	52322.4688	.0009	MZ	−0.0457	GCVS 85	-Ir	11)
AK Gem	52279.573	.004	AG	−0.011	GCVS 85	-Ir	1)
GI Gem	51149.5087	.0025	HSR	+0.0706	GCVS 85		16)
	51470.5587	.0035	HSR	+0.0710	GCVS 85		16)
	51553.313	.001	HSR	+0.072	GCVS 85		16)
TW Her	51671.4779		SIR	−0.0076	GCVS 85		9)
	51817.3305	.0014	ATB	−0.0090	GCVS 85		1)
	52039.5122		SIR	−0.0050	GCVS 85	-Ir	9)
	52121.4235	.0030	MZ	−0.0116	GCVS 85	-Ir	11)
	52123.4234	.0007	MZ	−0.0097	GCVS 85	-Ir	11)
VX Her	51798.376	.002	MZ	+0.118	GCVS 85	-Ir	6)
	52073.4134		WTR	+0.1099	GCVS 85		13)
VZ Her	51672.4704		SIR	+0.0494	GCVS 85		9)
	51772.426	.004	PS	+0.051	GCVS 85		3)
	51832.3121	.0017	ATB	+0.0521	GCVS 85		1)
AF Her	52054.4339	.0035	HSR	−0.0963	GCVS 85	-Ir	10)
DY Her	51672.5222	.0014	HSR	−0.0183	GCVS 85		16)
	52075.4608	.0014	JU	−0.0192	GCVS 85		4)
	52085.4183	.0014	JU	−0.0201	GCVS 85		4)
	52151.4102	.0004	MZ	−0.0205	GCVS 85	-Ir	11)
GY Her	51975.7057	.0100	HSR				10)
UU Hya	52338.357	.003	AG				1)
UV Hya	52344.473	.003	AG				1)
CR Hya	52307.556	.003	AG			-Ir	1)
ET Hya	52320.4897	.0002	MZ	+0.1182	GCVS 85	-Ir	11)
CZ Lac	51922.363 :	.003	MZ	−0.092	GCVS 85	-Ir	6)
	52134.587	.003	AG	−0.080	GCVS 85		1)
	52194.677	.007	AG	−0.067	GCVS 85		1)
	52228.367	.002	AG	−0.089	GCVS 85		1)
DE Lac	51671.5403	.0025	HSR	+0.0243	GCVS 85		16)
	51704.5269	.0025	HSR	+0.0308	GCVS 85		16)
	52123.3706	.0015	MON	+0.0267	GCVS 85	-Ir	1)
HY Lac	52144.397	.005	AG				1)
IV Lac	52228.401	.003	AG				1)
RR Leo	52052.4202	.0008	MZ	+0.0089	SAC 72	-Ir	11)
RX Leo	51974.6268	.0030	HSR	+0.0727	GCVS 85		10)
SS Leo	51974.5104	.0006	KI	−0.0225	GCVS 85	-Ir	1)
ST Leo	51956.638	.003	PS	−0.009	GCVS 85		3)
SZ Leo	51957.532	.004	PS	−0.205	GCVS 85		3)
WW Leo	52338.412	.003	AG	+0.030	GCVS 85		1)
	52344.441	.003	AG	+0.031	GCVS 85		1)
	52347.456	.003	AG	+0.032	GCVS 85		1)
V LMi	51974.5712	.0025	HSR				10)
Y LMi	52279.7396	.0090	HSR	−0.1066	GCVS 85		15)
TV Lib	52052.4075	.0008	KI	−0.0036	GCVS 85	-Ir	1)
EH Lib	51670.3939	.0007	HSR	+0.0021	GCVS 85		16)
	51670.4823	.0006	HSR	+0.0021	GCVS 85		16)
	52084.4315	.0010	MZ	+0.0005	GCVS 85	-Ir	11)
SZ Lyn	51907.4654	.0006	MZ	+0.0196	GCVS 85	-Ir	6)
	52053.4294	.0006	MZ	+0.0158	GCVS 85	-Ir	11)
	52202.6467	.0010	MON	+0.0109	GCVS 85	-Ir	1)
	52209.5192	.0010	MON	+0.0129	GCVS 85	-Ir	1)

Table 2: Pulsating stars Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
AN Lyn	52225.5922	.0012	MON			-Ir	1)
WW Lyr	52147.464	.005	AG				1)
CN Lyr	52094.4551	.0034	JU	+0.0055	BAVR 8)		4)
	52150.3940	.0014	MZ	−0.0037	BAVR 8)	-Ir	11)
	52187.428 :	.004	MZ	+0.006	BAVR 8)	-Ir	11)
EN Lyr	52147.551	.005	AG				1)
EZ Lyr	52190.3870	.0028	ATB	+0.0209	SAC 58		1)
FN Lyr	51811.5520	.0021	ATB	+0.0164	GCVS 85		1)
IO Lyr	51812.3653	.0028	ATB	−0.0163	GCVS 85		1)
	52093.4164	.0020	JU	−0.0240	GCVS 85		4)
	52112.4641	.0020	JU	−0.0214	GCVS 85		4)
	52175.3685	.0075	JU	−0.0233	GCVS 85		4)
KX Lyr	51874.3508	.0035	ATB				1)
	52183.4228	.0021	ATB				1)
NR Lyr	51853.3264	.0056	ATB				1)
QV Lyr	52199.3112	.0005	RAT RCR				1)
V535 Mon	51922.4786	.0009	KI			-Ir	1)
V567 Oph	51669.592	.002	HSR	−0.069	GCVS 85		16)
VV Peg	51817.4286	.0010	ATB	−0.0319	GCVS 87		1)
AE Peg	51901.2001	.0008	KI	+0.2142	GCVS 87	-Ir	1)
	51920.1200	.0007	KI	−0.2375	GCVS 87	-Ir	1)
AO Peg	51837.2957	.0012	KI	−0.0017	BAVR 13)	-Ir	1)
AV Peg	51811.4091	.0005	KI	+0.0641	GCVS 87	-Ir	1)
	52135.4261	.0002	MZ	+0.0702	GCVS 87	-Ir	11)
	52188.5186	.0035	ATB	+0.0717	GCVS 87		1)
	52196.3250	.0010	MON	+0.0706	GCVS 87	-Ir	1)
	52196.3287	.0003	WTR	+0.0743	GCVS 87		7)
BF Peg	52228.3803	.0056	ATB	+0.1181	GCVS 87		1)
BH Peg	51879.314 :	.001	MZ	−0.072	GCVS 87	-Ir	6)
	52193.3937	.0008	MZ	−0.0792	GCVS 87	-Ir	11)
BP Peg	51817.3072	.0006	KI	+0.0421	GCVS 87	-Ir	1)
	51832.535	.006	ATB	+0.043	GCVS 87		1)
	52118.4413	.0009	MON	+0.0415	GCVS 87	-Ir	1)
	52118.5451	.0009	MON	+0.0357	GCVS 87	-Ir	1)
	52213.3063	.0003	MZ	+0.0419	GCVS 87	-Ir	11)
	52217.3567	.0004	MZ	+0.0392	GCVS 87	-Ir	11)
CG Peg	52195.3101	.0010	MON	−0.0142	SAC 72	-Ir	1)
	52195.3133	.0006	WTR	−0.0110	SAC 72		7)
	52237.3500	.0028	ATB	−0.0168	SAC 72		1)
DH Peg	51840.408	.002	MZ	−0.003	GCVS 87	-Ir	6)
DY Peg	51758.5270		DDH	−0.0016	GCVS 87		4)
	51873.4569	.0009	MZ	−0.0036	GCVS 87	-Ir	6)
	51874.2607	.0009	KI	−0.0020	GCVS 87	-Ir	1)
	52112.4373	.0008	MON	−0.0027	GCVS 87	V	1)
	52112.5097	.0008	MON	−0.0032	GCVS 87	V	1)
	52120.5319	.0008	MON	−0.0029	GCVS 87	V	1)
	52120.6046	.0008	MON	−0.0032	GCVS 87	V	1)
	52202.4296	.0001	MZ	−0.0014	GCVS 87	-Ir	11)
DZ Peg	51902.2556	.0009	KI	−0.0034	SAC 72	-Ir	1)
ES Peg	51812.6068	.0014	ATB				1)
AR Per	51923.482	.001	MZ	+0.045	GCVS 87	-Ir	6)
	52267.3222	.0017	MZ	+0.0423	GCVS 87	-Ir	11)
	52267.3271	.0011	JU	+0.0473	GCVS 87		4)
ET Per	52179.524	.004	AG	−0.013	BAVR 13)		1)
	52183.464	.004	AG	−0.013	BAVR 13)		1)
RU Psc	51901.393 :	.004	MZ	−0.016	GCVS 87	-Ir	6)
	52258.373 :	.002	MZ	+0.153	GCVS 87	-Ir	11)
SS Psc	51887.3692	.0012	KI	−0.0833	GCVS 87	-Ir	1)
	52202.5157	.0041	PC	−0.0699	GCVS 87	-Ir	12)
	52228.4252	.0008	MZ	−0.0618	GCVS 87	-Ir	11)

Table 2: Pulsating stars Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
SS Psc	52264.3856	.0015	JU	-0.0754	GCVS 87		4)
GW Sge	52087.519	.004	AG				1)
BH Ser	51975.6281	.0017	HSR	$+0.0571$	GCVS 87		10)
	52049.4992	.0010	QU	$+0.0542$	GCVS 87	V	14)
	52092.5177	.0018	MZ	$+0.0519$	GCVS 87	-Ir	11)
UU Tri	51564.2934	.0100	PS			R	3)
UX Tri	51810.5809	.0028	ATB				1)
	51817.5708	.0069	ATB				1)
	51853.5399	.0035	ATB				1)
	51854.4687	.0021	ATB				1)
	51904.4160	.0056	ATB				1)
	51921.2761	.0028	ATB				1)
	51926.4039	.0028	ATB				1)
	51927.3355	.0049	ATB				1)
	51934.3279	.0069	ATB				1)
	51948.3021	.0083	ATB				1)
	51983.3466	.0042	ATB				1)
	52191.6007	.0017	ATB				1)
	52198.5891	.0035	ATB				1)
	52213.5110	.0070	ATB				1)
	52224.2966	.0010	MON			-Ir	1)
	52228.4968	.0028	ATB				1)
	52233.6315	.0025	ATB				1)
	52280.3159	.0008	MZ			-Ir	11)
VX Tri	52228.3956	.0020	FR			-Ir	5)
RV UMa	52001.4749	.0035	JU	$+0.0030$	SAC 72		4)
	52002.4073	.0035	JU	-0.0008	SAC 72		4)
	52003.3444	.0036	JU	$+0.0002$	SAC 72		4)
AE UMa	52025.4245	.0007	JU	$+0.0007$	GCVS 87		4)
	52050.4524	.0010	JU	-0.0024	GCVS 87		4)
	52051.3986	.0014	JU	-0.0025	GCVS 87		4)
ST Vir	52040.3910	.0004	KI	$+0.0846$	GCVS 87	-Ir	1)
UU Vir	51644.4040	.0015	HSR	-0.0144	GCVS 87		16)
BC Vir	52049.4329	.0009	KI	$+0.0489$	GCVS 87	-Ir	1)
BN Vul	52123.5020	.0022	PC	-0.0215	SAC 72	-Ir	12)
	52123.5020	.0022	PC	-0.0215	SAC 72	-Ir	12)
	52151.4248	.0015	JU	-0.0232	SAC 72		4)
	52176.3783	.0014	MZ	-0.0234	SAC 72	-Ir	11)
	52198.360	.001	JU	-0.024	SAC 72		4)
FH Vul	51708.5649	.0020	HSR	-0.0246	BAVR 13)		16)

Remarks:

AG :	Agerer, F., Tiefenbach	ATB:	Achterberg, Dr. H., Norderstedt
BRN:	Brauner, B., Herford	DDH:	Diederich, H., Darmstadt
DIE:	Dietrich, M., Radebeul	FR :	Frank, P., Velden
HSR:	Husar, Dr. D., Hamburg	JU :	Jungbluth, Dr. H., Karlsruhe
KI :	Kleikamp, W., Marl	MON:	Monninger, G., Gemmingen
MS :	MS: Moschner, W., Lennestadt	MZ :	Maintz, G., Bonn
PC :	Poschinger, K., Hamburg	PS :	Paschke, A. Rüti (CH)
QHL:	Quehl, Dr. W., Kornwestheim	QU :	Quester, W., Esslingen
RAT:	Rätz, M. Herges-Hallenberg	RCR:	Rätz, Ch. Herges-Hallenberg
RTZ:	Rätz, S. Herges-Hallenberg	SIR:	Schirmer, J., Fredenbeck
STK:	Strunk, J., Leopoldshöhe	WTR:	Walter, F., München

Remarks (cont.):

:	= uncertain
s	= secondary minimum
red	= reduced results
	=
1)	= photometer ST-6, uncoated, filter V/ B/ -Ir
2)	= photometer EMI 9781A, filter V=GG495,1mm
	= B=BB12,1mm+GG385,2mm / U=UG1, 2mm
3)	= photometer Cryocam 80A, without filter
4)	= photometer ST-7, filter V / R / -Ir=KG5/2 / Ic / or non
5)	= photometer OES-LcCCD11, filter -Ir or without filter
6)	= photometer LC14, filter -Ir
7)	= photometer pictor 1616XT, without filter
8)	= photometer ST-9
9)	= photometer AlphaMaxi, filter -Ir
10)	= photometer AP7 chip SITe502AB filter -Ir or without filter
11)	= photometer AlphaMini, filter -Ir
12)	= photometer ST-8E, filter without, -Ir, V/R (Bessel type)
13)	= photometer Pictor 416XT filter without
14)	= photometer ST-7E filter V; R; -Ir=KG/2; without filter
15)	= photometer ST-8E chip: KAF1602E without filter
16)	= photometer ST-7 chip: KAF0400 without filter
17)	= evaluation: supported by the software MIRA AP
18)	= team BCK, OTT, QHL, QU Stuttgart observatory
GCVS *yy*	= General Catalogue of Variable Stars, 4th ed. 19*yy*
IBVS *nnnn*	= Information Bulletin on Variable Stars No. *nnnn*
MVS vv,ppp	= Mitteilungen über Veränderliche Sterne; volume,pages
SAC *vv*	= Rocznik Astronomiczny No. *vv*, Krakow (SAC)
BAVM *nnn*	= BAV Mitteilungen No. *nnn*

BAVM 51	= IBVS No. 3234		
BAVM 53	= IBVS No. 3401		
BAVM 55	= IBVS No. 3554	BAVR 1	= BAV Rundbrief 32, 36 ff
BAVM 57	= IBVS No. 3555	BAVR 2	= BAV Rundbrief 32,122 ff
BAVM 61	= IBVS No. 3797	BAVR 3	= BAV Rundbrief 33,152 ff
BAVM 63	= IBVS No. 3811	BAVR 4	= BAV Rundbrief 33,160 ff
BAVM 64	= IBVS No. 3837	BAVR 5	= BAV Rundbrief 35, 1 ff
BAVM 65	= IBVS No. 3859	BAVR 6	= BAV Rundbrief 35, 41 ff
BAVM 67	= IBVS No. 3942	BAVR 7	= BAV Rundbrief 36,157 ff
BAVM 71	= IBVS No. 4131	BAVR 8	= BAV Rundbrief 43, 57 f
BAVM 72	= IBVS No. 4132	BAVR 9	= BAV Rundbrief 44,162 f
BAVM 73	= IBVS No. 4133	BAVR 10	= BAV Rundbrief 47, 33 f
BAVM 82	= IBVS No. 4266	BAVR 11	= BAV Rundbrief 48, 57
BAVM 87	= IBVS No. 4332	BAVR 12	= BAV Rundbrief 49,117
BAVM 89	= IBVS No. 4381	BAVR 13	= BAV Rundbrief 49, 41
BAVM 94	= IBVS No. 4406	BAVR 14	= BAV Rundbrief 49,105
BAVM 97	= IBVS No. 4481	BAVR 15	= BAV Rundbrief 48,189
BAVM 110	= IBVS No. 4590	BAVR 16	= BAV Rundbrief 49, 6
BAVM 115	= IBVS No. 4669	BAVR 17	= BAV Rundbrief 50, 45
BAVM 123	= IBVS No. 4778		
BAVM 132	= IBVS No. 5016		
BAVM 133	= IBVS No. 5017		

ERRATUM FOR IBVS 4912

IBVS No.4912:	UZ Cvn	51245.410	HSR	must be deleted
	SZ Gem	51250.5464	ATB	must be deleted

ERRATUM FOR IBVS 5296

Correction to IBVS 5296 = BAVM 152

ER Vul 52141.424 AG correct starname: ER Peg

COMMISSIONS 27 AND 42 OF THE IAU
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THE RR LYRAE VARIABLE CH Oph AND A NEW MIRA IN ITS FIELD

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The variable star CH Oph was discovered by Swope (1928). Later the discoverer published a low-quality photographic finding chart (Swope 1932). The star was never studied in detail, the GCVS (Kholopov 1985) gives no type for the star and only the variability range (15.5 to fainter than 16.5 pg).

In our current effort to provide identifications and accurate coordinates for all stars of the GCVS (cf. Samus et al., 2002), we are now working on the constellations of the GCVS Volume II. The variable CH Oph could not be readily found from its published coordinates and the finding chart. An attempt to recover the variable using archive images provided by the US Naval Observatory Flagstaff Station revealed a variable object not far from the GCVS position of CH Oph. However, the positional difference was larger than usual for variables discovered by H.H. Swope in 1920ies. A check in the Harvard plate stacks has shown that our variable object is not identical with the real CH Oph, which was also identified beyond doubt. Figure 1 presents the finding chart for both variables. The coordinates of the two stars from the Guide Star Catalogue, Version 2.2.01, are:

$$\text{CH Oph} \quad 16^{\rm h}54^{\rm m}03\overset{\rm s}{.}5, \quad -27^\circ14'45'', \quad 2000.0;$$

$$\text{New var.} \quad 16^{\rm h}54^{\rm m}05\overset{\rm s}{.}9, \quad -27^\circ16'47'', \quad 2000.0.$$

We estimated the brightness of the two variables on 88 plates of the Moscow collection taken with the 40 cm astrograph in Crimea (JD 2437109–2448454). We used comparison stars from the Tycho2 and USNO A2.0 catalogs.

CH Oph is an RR Lyrae (RRAB) star with the elements

$$\text{Max Hel} = 2447264.573 + 0\overset{\rm d}{.}561375 \times E.$$

It varies between $14\overset{\rm m}{.}5$ and $16\overset{\rm m}{.}0$ B. Note that, for this southern region, the limiting magnitude of our plate collection is usually between $15\overset{\rm m}{.}5$ and $16\overset{\rm m}{.}5$, so the star is a difficult object for our plates. Its light curve (Fig. 2) shows a considerable scatter near minimum.

Our new variable is a Mira, with the variability range from $12\overset{\rm m}{.}3$ to fainter than $16\overset{\rm m}{.}5$ B (Fig. 3). It can be identified with IRAS PSC 16509–2711. The star's light elements are

$$\text{Max} = 2447740 + 349\overset{\rm d}{.}4 \times E.$$

The GCVS work is supported, in part, by grants from the Russian Foundation for Basic Research (02-02-16069), the Federal Scientific and Technological Program "Astronomy", and the program of support for leading scientific schools of Russia (00-15-96627). The Digitized Sky Survey images are provided by the Hubble Space Telescope Science Institute under support from grant NAG W-2166 of the USA Government. Thanks are due to Dr. S.V. Antipin for his assistance during the preparation of the manuscript.

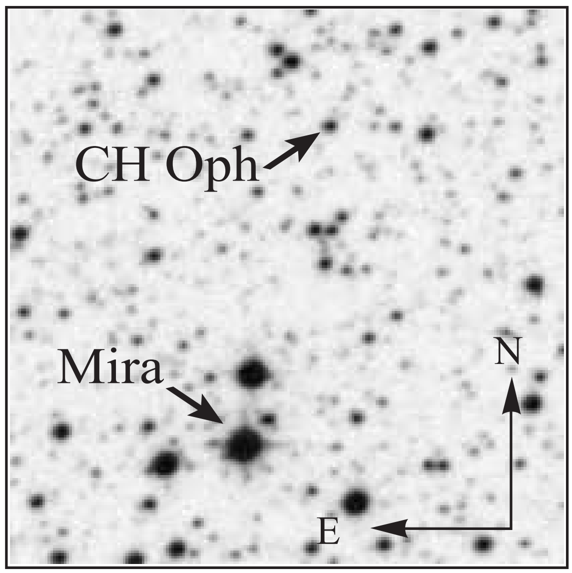

Figure 1. The finding chart for CH Oph and the new Mira variable. The size of the chart is $3.'5 \times 3.'5$. This is a red image of the second Digitized Sky Survey.

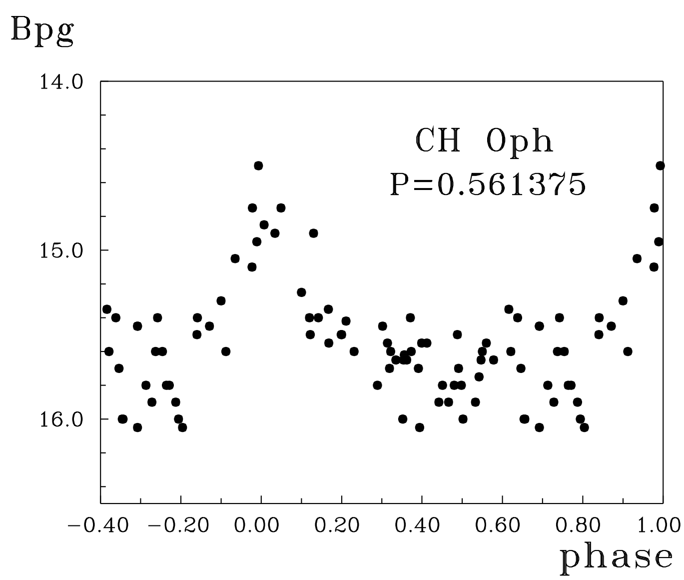

Figure 2. The *B* light curve of CH Oph.

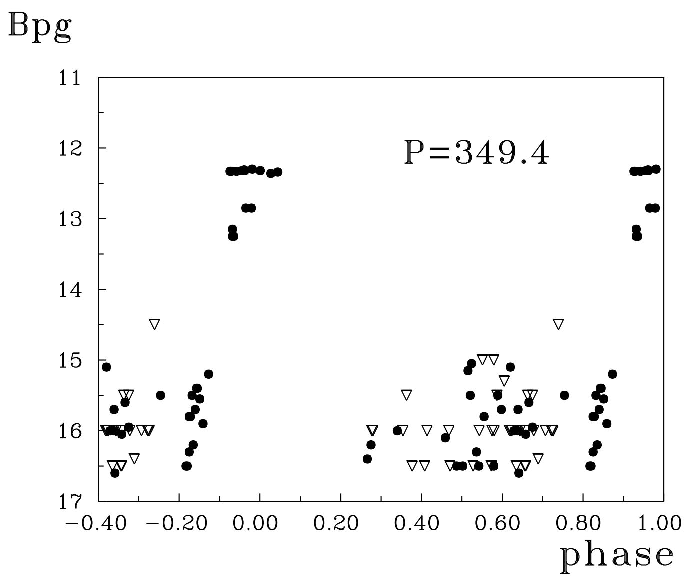

Figure 3. The B light curve of the new Mira variable in the field of CH Oph. Triangles are bright limits.

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COORDINATES AND IDENTIFICATIONS OF HARVARD VARIABLES

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Of the more than 13,000 variable stars discovered in the course of Harvard sky photography from roughly 1890 to 1950, a large fraction are identified only by approximate coordinates in their discovery announcements, a circumstance which has confounded recovery and subsequent research on these variables. In this paper, we have employed original notebooks to identify variables announced or recovered by Dorrit Hoffleit, and published by her in the 1930's in five papers in the *Bulletins of the Harvard College Observatory* (Hoffleit 1930, 1931, 1932, 1935, 1936). Fortunately, the discovery series plates she employed survive intact with their markings. Most of the variables we identify here lack published finding charts; those charts which have been published often rest on nominal positional coincidence with the original approximate coordinates, and have not hitherto been confirmed.

The principal results of this paper are contained in five Tables, one for each discovery paper, which may be found following this introductory text. The introduction itself includes a description of the structure and annotation of the Tables, followed by brief accounts of the scope of each of the discovery papers, with remarks as appropriate clarifying cases of confusion with other field variables. The Tables themselves list coordinates and identifications for variable stars found in the corresponding discovery paper, arranged in the same order as they appeared in that paper. Appended to each list of new or recovered variables is a list of previously known variables lying in the same field, as drawn from the *Katalogen und Ephemeriden Veränderlicher Sterne* published by Prager (1929, 1930, 1931, 1934, 1935) for the corresponding year of publication, because their attempted recovery was included within the scope of Hoffleit's studies. Each Table is followed by a bibliography of published finding charts referenced in that Table, and Remarks containing additional information and identifications for variables listed in that Table.

Each Table lists in successive columns: (1) the assigned variable star name, (2) Harvard Variable number, (3) Guide Star Catalog (GSC: Lasker, *et al.* 1990) identification, (4) Right Ascension, (5) Declination, (6) Infrared Astronomical Satellite (IRAS: Joint IRAS Science Working Group 1986) identification, (7) variability type, and (8) references to published finding charts consulted during the course of this investigation.

Problematic objects are marked by a cross (†) appended to their entries in column (1), referring the reader to a more detailed discussion following below. These objects include several instances in which variables were misidentified by subsequent investigators, with a different variable or suspected variable in the same field erroneously assigned the name of the Harvard Variable in question. However, they do not include simple cases of erroneous finding charts, which are identified in column (8).

The coordinates given in columns (4) and (5) are uniformly in the GSC1.1 reference system (Lasker, *et al.* 1992). Each variable was identified on a $15' \times 15'$ image of its field generated from the Digitized Sky Survey. Where the variable was found in GSC1.1, the coordinates quoted are the means of all GSC catalog entries classified as stellar. Where an asterisk (*) has been appended to the GSC number in column (3), all of the individual entries in the GSC corresponding to that number were classified non-stellar. In these cases (as well as those variables without GSC counterparts) the coordinates were measured directly on a digitized Guide Star Survey plate, using the Guide Star Astrometric Support Package from the Space Telescope Science Institute. In a few instances (marked by *colons* in columns 4 and 5), the variable in question is so badly blended with a neighbouring star that automatic centering algorithms fail, and it was necessary to estimate coordinates by eye. In a few cases, a variable was not discernable on any of the Guide Star Survey plates, but it is clearly registered on the SRC-J and ESO-R plates (southern fields) or POSSI-E and POSSI-O plates (northern fields) used to compile the USNO-A1.0 catalog; its coordinates were then adopted from that catalog, which is based on the GSC1.1 reference system. This is also the reference system adopted in the Digitized Sky Survey at

`http://archive.stsci.edu/dss/index.html`

through which field charts can be generated as needed for each of the variables included here.

IRAS counterparts listed in column (6) were identified by positional coincidence from the IRAS Point Source Catalog (Joint IRAS Science Working Group 1986), Faint Source Catalog (entries preceded by an 'F': Moshir, *et al.* 1989), or Serendipitous Source Catalog (preceded by an 'S': Kleinmann, *et al.* 1986). Those identifications followed by a question mark (?) lie within the 99% error ellipse of the corresponding IRAS catalog, but outside the 90% error ellipse. A similar identification procedure was followed for the MSX5C (Egan, *et al.* 1999) and ROSAT (1RXS: Voges, *et al.* 1999; 1RXS-F: Voges, *et al.* 2000; 1RXH: ROSAT Scientific Team 2000; 2RXP: ROSAT Consortium 2000) counterparts listed in the Remarks following Table 1.

The variability types shown in column (7) have been drawn from the Fourth Edition of the General Catalog of Variable Stars (GCVS: Kholopov, *et al.* 1985*a*, 1985*b*, 1987). In some cases, marked by an asterisk (*), the classification in column (7) has been truncated; the full GCVS classification is then given in the Remarks following the table.

Incorrect charts are identified by *italics* in column (8). However, only charts which unambiguously mark the wrong star are identified in this way. Many charts not identified here as clearly erroneous are nevertheless inadequate for unique identification of the variables to which they refer; those in the *Charts for Southern Variables* series and in the *AAVSO Variable Star Atlas* frequently mark only the general location of the variable. A bibliography of finding charts, by number, follows immediately after each Table. An asterisk (*) in column (8) refers the reader to additional comments in the Remarks to that Table.

Remarks to each Table, including numerous other catalog identifications, follow the finding chart bibliography. Full variability classifications from the GCVS are listed here for entries truncated in column (7) of the corresponding Table. Except as noted in Remarks, all variables have counterparts in both USNO-A1.0 (Monet, *et al.* 1996) and USNO-A2.0

(Monet, *et al.* 1998) catalogs. In addition, portions of most fields are covered in the Second Incremental Data Release of the 2MASS near-infrared survey (Cutri, *et al.* 2000). Those variables falling within the coverage of that release are here identified or else noted as undetected. Also noted in the Remarks is the presence of close companions which may have affected GSC, USNO-A1.0, or USNO-A2.0 positions, or which may otherwise confuse identification of the variable. We do not mean to imply that any of these companions are physical. In a few cases, we note the appearance of the variable on other plate series in the Digitized Sky Survey, where its clear variability served to confirm its identity. Plate series referenced in the Remarks are identified as Guide Star Survey (GSS), first-epoch Digitized Sky Survey (DSS1), or second-epoch Digitized Sky Survey (DSS2), along with the corresponding plate identification number.

We close this introduction with a summary account of the methods used to determine the coordinates originally reported for variable stars discovered in the Harvard surveys — methods which do not seem to have been previously published elsewhere. The position of each variable was measured relative to two Durchmusterung stars, one north preceding (or following), the other south following (or preceding) the variable. These stars were marked on the plate from which the variable star coordinates were to be determined. For this purpose, A-series plates (scale $60''$/mm) were used for the southern hemisphere, and MC-series plates (scale $98''$/mm) for the northern hemisphere. Millimeter graph paper was attached to a piece of glass the same dimensions as the plate from which the stellar positions were to be determined. The photographic plate was then mounted above the graph paper, and x, y coordinates of the variable and the comparison stars were read off the graph paper, using only a hand-held 2-inch magnifying glass. The coordinates recorded were then plotted on the graph paper and the plate again superposed to verify that the stars properly fell on top of the plotted coordinates. From these measurements and the celestial coordinates of the Durchmusterung stars, the right ascensions and declinations of the variables were interpolated.

Despite the primitive methods used to determine the positions reported in Hoffleit's discovery papers, most of them have proven reliable, with median errors of $0\overset{\prime}{.}21$, $0\overset{\prime}{.}25$, $0\overset{\prime}{.}29$, $0\overset{\prime}{.}52$, and $0\overset{\prime}{.}39$ for Tables 1-5, respectively. Some accidental errors may be attributed to the fact that nearly all the Durchmusterung reference stars are brighter than $m_{\rm pg} = 10$, whereas three-fourths of the variables are no brighter than $m_{\rm pg} = 14.0$ at maximum, the brightest (OO Aql) reaching only $m_{\rm pg} = 9.9$. In a small number of cases, large positional discrepancies occur, but they are nearly always large in one coordinate only, and evidently arose from clerical or typographical errors.

Table 1: Milky Way Field 167

This field, lying entirely within the constellation Centaurus, was the subject of the first of Hoffleit's discovery papers (Hoffleit, 1930). Of the the 151 variable stars found in Table I of that paper, and identified here in Table 1, 124 (HV 4717-4840) were new discoveries, 25 (HV 4637-4661) were previously discovered by Waterfield (1929), and for the remaining two (AF and AU Cen) types and periods were first determined by Hoffleit. Five additional, previously known variables, listed by Prager (1929) and lying within the field of study, are appended here to Table 1. For a handful of objects identified here (BL Cen, BM Cen, BV Cen, BZ Cen, and CL Cen), errors in the reported discovery positions exceed $5'$; however, only for the well-known dwarf nova BV Cen are these errors significant in both coordinates.

Among the variables in Table 1, the reader will notice the identification of a number of objects, putatively classified as of rapid but unknown type (S) or as of RR Lyrae type

(RR), which are coincident with IRAS point sources. In none of these cases does a likely alternative source (bright or suitably red in the USNO-A2.0 catalog) appear within the IRAS error ellipse. Ephemerides have never been determined for any of these objects, and it now appears likely that they must have been misclassified.

Four of the variables listed in Table 1 (AF-AI Cen) were originally discovered on Sydney Observatory plates by Wood (1920). Unfortunately, his account provides only very crude positions, and asserts variability from only 8, 4, 2, and 4 photographic observations, respectively, the latter three on the basis of a single discrepant observation each. Hoffleit successfully recovered only AF Cen. For AG Cen and AI Cen, the coordinates listed in Table 1 refer to the candidates she identified, neither of them showing any perceptible variation. In the case of AH Cen, no candidate was indicated, but again no variability was detected in any star near Wood's nominal position.

Table 2: Milky Way Field 175

Milky Way Field 175 straddles the border between the constellations Norma, to the north, and Triangulum Australe, to the south, extending partway into Ara to the north-east. Table 2 lists coordinates and identifications for the 289 variable stars found in Table I of the discovery paper devoted to this field (Hoffleit, 1931). As in Table 1, a list of previously known variables (Prager, 1930) in this same field is appended Table 2. These additional variables number 19, but do not include a further seven objects (NSV 07640, 07648, 07699, 07767, 07774, 07804, and LQ Nor) found by Voûte, not recovered by Hoffleit, but recently identified from Voûte's descriptions by Morel (1992).

Although the approximate positions reported in Hoffleit's discovery paper have mostly proven reliable, the declinations of three variables are discrepant by a full degree. AS TrA is 1° north of its reported discovery position, and lies not in Triangulum Australe, but in Norma. EG Nor is 1° south of its reported position, and lies not in Norma, but in Triangulum Australe. GG Nor is also 1° south of its reported position, and has been verified as identical with QT Nor (= HV 8903 = 787.1935), discovered independently by Luyten (1938).

As in Table 1, we have found a number of putative rapid variables (type S) or RR Lyrae stars (type RR) coincident with IRAS point sources. Once again, in none of these cases does a likely alternative source (bright or suitably red in the USNO-A2.0 catalog) appear within the IRAS error ellipse, nor, with the singular exception of DS TrA, have ephemerides ever been determined for any of these objects. It is likely that these variables have been misclassified.

Table 3: Milky Way Field 30

Milky Way Field 30 lies principally in the constellation Aquila, extending northward barely into Sagitta. Table 3 lists coordinates and identifications for the 75 variable stars found in Table I of the discovery paper devoted to this field (Hoffleit, 1932). As in Tables 1 and 2, a list of 56 previously known variables in this same field is appended to Table 3. These appended variables are drawn from Prager's (1931) catalog in those cases in which they had already been assigned names according to standard variable star nomenclature, but with additional objects, suspected but not yet named at the time, drawn from discoveries by Fleming (Pickering, 1906), Wolf (1904*a*,*b*), Wolf & Wolf (1905*a*,*b*, 1906), Ross (1928), and Buser (1929).

Several objects in this field presented identification conflicts, in which later investigators assigned the names originally conferred on variables in Hoffleit's discovery list to other variables, or suspected variables, that they discovered independently in their vicinity:

Hoffleit (1932) found HV 5424 to be a small-amplitude variable (15.1-15.5 pg) of indeterminate type. Hoffmeister (1940) believed he had recovered this star, describing it as probably a slow variable. On the strength of that seeming confirmation the designation V449 Aql was assigned to his variable in Name-List 38 (Guthnick & Schneller, 1941). Between August 1935 and September 1944, 180 plates of the field of γ Aql were secured at Sonneberg Observatory as part of a variable star survey of the northern Milky Way. A short summary of those observations was published by Ahnert, *et al.* (1949), who described this star as an irregular variable (range 14.3-15.6 pg).

A chart of the Sonneberg identification appeared eight years later (Hoffmeister, 1957). In fact, Hoffleit's and Hoffmeister's variables are two different stars, a mere $1\rlap{.}'7$ apart. Since the literature, variability type, range, and spectral type quoted in the General Catalog of Variable Stars all refer to Hoffmeister's variable, we retain its designation as V449 Aql, and list it among the 'Known variables' at the end of Table 3. This star is evidently the M6.5 star identified as V449 Aql by Cameron & Nassau (1956) on the basis of positional coincidence alone. Hoffleit's star remains HV 5424 in the principal body of Table 3, but its apparent range is so small as to call its variability into question.

HV 5461 was discovered as a variable of modest amplitude (15.0-16.0 pg) of indeterminate type, and assigned the designation NS Aql in the 30th Name-List of variable stars (Guthnick & Prager, 1932) on the strength of Hoffleit's (1931) observations alone. On a series of 144 plates obtained between July 1960 and October 1969 with the 0.40-m astrograph at the Southern Station of the Sternberg State Astronomical Institute, Shaganyan & Vypirajlo (1975) identified a star some $1\rlap{.}'1$ away as this variable. That star, entered as 'ShV sv' in the list of 'Known variables' at the end of Table 3, they found either constant, or weakly, irregularly variable with small amplitude ($0\rlap{.}^{m}2 - 0\rlap{.}^{m}8$ $B_{\rm pg}$). NS Aql itself is a bright near-infrared source in the 2MASS survey (unlike ShV sv), and is clearly variable on Digital Sky Survey plates. The variability type 'L' appearing in the General Catalog of Variable Stars derives from the paper by Shaganyan & Vypirajlo, and is here transferred to ShV sv.

The confusion surrounding the identity of HV 5469 has been described by Hazen *et al.* (2002), who establish it as identical with V926 Aql. The nearby variable OP Aql, originally identified as HV 5469, was in fact a new variable discovered by Gessner (1959). We note that Paschke (1990) finds two additional putative variables near V926 Aql: a suspected eclipsing system ($B = 16\rlap{.}^{m}0$, $R = 15\rlap{.}^{m}1$ in USNO-A2.0) at $19^{h}48^{m}14\rlap{.}^{s}213$, $+09°23'13\rlap{.}''45$ (J2000), and a suspected RR Lyrae variable ($B = 16.0$, $R = 14.6$ in USNO-A2.0) at $19^{h}48^{m}11\rlap{.}^{s}824$, $+09°25'44\rlap{.}''31$ (J2000).

Two variables included in the 2MASS Second Incremental Data Release have near-infrared properties inconsistent with their ascribed variability type: NT Aql, a rapid variable of indeterminate type, is infrared-bright, while PQ Aql, a putative semiregular variable, is infrared-faint.

Table 4: Milky Way Fields 105, 108, and 111

Milky Way Fields 105, 108 and 111 straddle the boundary between the constellations of Auriga, to the north, and Taurus, to the south. Table 4 lists coordinates and identifications for the 67 variable stars found in Table I of the discovery paper devoted to these fields (Hoffleit, 1935). These variables are followed by 20 suspected variables from Hoffleit's Table II. As in Tables 1-3, a list of 48 previously known variables in this same field is appended to Table 4. These appended variables are drawn from Prager's (1934) catalog in those cases in which they had already been assigned names according to standard variable star nomenclature, but with additional objects, suspected but not yet named at the time, drawn from discoveries by Ross (1927), Hoffmeister (1930, 1931), and Shajn (1933).

Of the discovery positions published in 1935, only NSV 01958 is found more than 5′ from its announced position. Nevertheless, we are aware of three apparent misidentifications which warrant further comment. In 1976, Tsesevich published his *Studies of Variable Stars in Selected Regions of the Galactic Field* (Tsesevich, 1976). Among the many variables included in that monograph are a number belonging to Hoffleit's (1935) discovery list, including two (NSV 01829 and PR Aur) with discrepant finding charts. The third case involves NSV 01812 (= CSV 100436), which Kurochkin (1951) believed he had recovered.

Tsesevich's chart labeled CSV 492 marks a star 2.′7 south of Hoffleit's variable, HV 6877, the true CSV 492 (= NSV 01829). His identification is included here among the appended stars, where it is identified as 'Ts 492'. He compiled a light curve for it from the plate collection at the Sternberg State Astronomical Institute, using 38 plates taken between December 1959 and November 1965 at Odessa, and a further 194 taken between October 1965 and March 1970 at Moscow. Despite finding modest dispersions in brightness in each of these plate series ($0\overset{m}{.}12$ rms, range 13.95 - 14.87: pg at Odessa; $0\overset{m}{.}17$ rms, range 14.23 - 14.94 pg at Moscow), he did not regard the variations he found as real. Hoffleit found HV 6877 itself to be of moderately large amplitude (12.5 - 14.0 pg), and we confirm that it does appear to vary on Harvard plates.

The situation is very similar in the case of PR Aur. Tsesevich's chart labeled CSV 494 marks a star 34″ southeast of Hoffleit's variable, HV 6878. On 193 plates taken between September 1949 and March 1970 at Moscow, his estimates range from 15.10 pg to 15.81 pg. Despite finding an even smaller dispersion in brightness for this star ($0\overset{m}{.}14$ rms) than for the star he identified as CSV 492 (Ts 492 above), he considered it a true irregular variable of small amplitude. On the basis of his observations, the designation PR Aur was assigned to this star in Name-List 62 (Kukarkin, *et al.*, 1977). We therefore include Tsesevich's star under the name PR Aur in the list of known variables appended to Table 4, but retain HV 6878 together with its aliases in the main body of that table. Hoffleit found HV 6878 itself to be of relatively small amplitude (range 14.9 - 15.6 pg).

Kurochkin studied 43 variable stars on plates taken between 1895 and 1951 at Moscow and Tashkent Observatories, among them one which he identified as CSV 100436 (= NSV 01812), which actually lies 3.′4 south-southeast of the unnumbered suspected variable Hoffleit listed at $04^h57^m26^s$, $+32°52.'6$ (1900) in her Table II. Kurochkin considered his star a likely eclipsing variable of very small amplitude, and listed seven putative times of minimum; this is the source of the tentative classification (E:) in the New Catalog of Suspected Variables. In Table 4, Hoffleit's star is listed in the main body as NSV 01812, but now of indeterminate type, while Kurochkin's suspected variable appears in the appended list of known variables as 'Kur sv'. Hoffleit found her suspected variable to be of very small and uncertain amplitude (12.9 - 13.2 pg).

Table 5: Milky Way Field 239

Milky Way Field 239 straddles the boundary between the constellations of Centaurus, to the north, and Lupus, to the south. Hoffleit (1936) announced the discovery in this field of 107 new variable stars (HV 7375-7481), plus the rediscovery of another 16 previously announced by Luyten (1933, 1935) when he was at Harvard. Kazanasmas (1964), and later Tsesevich & Kazanasmas (1971), published finding charts for most of these variables, but while we can now confirm that these charts are accurate, they are not always adequate for identifying unambiguously the variables in question. Apart from a follow-up study of these variables by McLeod & Swope (1941), they have nearly all languished in obscurity.

Table 5 lists coordinates and identifications for the 107 variable stars found in Table I of the discovery paper, followed by the 16 variable stars previously discovered by Luyten, from Hoffleit's Table II. As in Tables 1-4, a list of 13 previously known variables in this same field is appended to Table 5. These appended variables are drawn from Prager's (1935) catalog, in those cases in which they had already been assigned names according to standard variable star nomenclature, but with the additions of AO Cen (Cannon 1921), omitted from Prager's catalog, and of other objects suspected but not yet named at the time, drawn from discoveries by Luyten (1933, 1935).

Of the discovery positions published in 1936, none are in error by more than two arcminutes. However, a clerical error in preparation of Hoffleit's original paper led to the positions of HV 7441 (= DY Lup) and HV 7442 (= DZ Lup) being exchanged, as they are also on the charts by Kazanasmas (1964) and Tsesevich & Kazanasmas (1971). The types, ranges, and ephemerides of these two variables remain unchanged.

IRAS 14402-4049 appears coincident with the putative RR Lyrae variable V642 Cen. However, a more likely optical counterpart to this IRAS source may be the bright ($V = 8.00$) F5V star HD 129364, which lies just outside the IRAS 99% confidence ellipse.

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Table 1: Positions and identifications in MWF 167

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
AF Cen		8656-02748	13 04 07.555	–56 20 14.60	13011–5604	M	18
BL Cen	4637	8652-02168	13 06 31.954	–55 34 52.39	13035–5518	M	
CO Cen	4717		13 07 26.512	–55 55 27.39		M	14 19
CP Cen	4718		13 07 42.171	–56 31 48.53	13046–5615	S:	14 19
CQ Cen	4719	8653-00173	13 08 03.401	–55 29 18.24		E/SD:	13
CR Cen	4720		13 09 51.562	–57 42 12.10	13067–5726	M	2 14 19
CS Cen	4721		13 09 54.563	–56 58 34.74	13068–5642	M	2 14 19
CT Cen	4722	8661-00660	13 10 42.949	–58 16 39.38		EA*	2 18
CU Cen	4723	8657-01216	13 10 56.326	–56 47 29.44		E:	14 19
CV Cen	4724		13 11 42.565	–56 59 48.26	13086–5643	SR	14 19
CW Cen	4725	8653-00800	13 11 55.442	–55 04 58.19	13088–5449	S:	14 19
CX Cen	4726	8657-01359	13 12 14.909	–56 59 21.70		E/SD	2 13
CY Cen	4727	8649-01090	13 12 12.995	–52 52 52.36		EA*	14 19
CZ Cen	4728	8649-00140	13 12 42.056	–52 31 04.03	13096–5215	SR	14 19
DD Cen	4729	8653-01662*	13 12 59.940	–55 21 21.79	13099–5505	S:	14 19
DE Cen	4730	8649-01139	13 13 02.539	–53 13 13.33		E/SD:	*14 19*
DF Cen	4731	8657-01118	13 13 12.754	–57 08 49.42		L	2 14 18 19
DG Cen	4732		13 13 10.244	–51 12 53.23	13101–5056	M	14 19
DH Cen	4733	8255-02002	13 13 21.626	–49 17 36.89		E	
DI Cen	4734	8653-01037	13 15 09.662	–55 58 07.39		EA*	13
BM Cen	4638		13 17 38.440	–56 17 09.71		EA*	2 13
DK Cen	4735	8661-00024	13 17 24.412	–58 23 21.76		EA*	2 13
DL Cen	4736	8657-01410	13 17 37.044	–56 48 32.80	13145–5632	RR	14 19
BN Cen	4639		13 18 40.405	–57 35 24.02	S13156–5720	M:	14 19
BO Cen	4640		13 18 39.703	–54 04 46.11		M	14 19
BP Cen	4641	8256-01469	13 19 08.686	–49 55 04.74		EA*	14* 19*
DM Cen	4737		13 19 30.098	–54 22 23.57		SR	
DN Cen	4738	8670-02025	13 20 22.130	–58 02 08.81		EB*	2 19 21
DO Cen	4739		13 20 10.011	–50 47 58.17		RR:	
BQ Cen	4642	8256-01141	13 20 27.913	–50 37 20.52		S:	14 19
DP Cen	4740	8260-00399*	13 20 38.362:	–52 09 30.43:		E/SD:	14 19
DR Cen	4741		13 21 09.312:	–52 07 58.36:	13181–5152	M	14 19
DQ Cen	4742	8674-03074	13 21 19.865	–58 11 15.50	13181–5755?	S:	
DS Cen	4743		13 21 40.885	–50 17 26.14		RR	
DT Cen	4744	8666-01289	13 22 52.978	–54 51 58.21	13197–5436		
DU Cen	4745		13 23 39.952	–55 29 39.02		E/SD:	
DV Cen	4746	8662-01937	13 24 19.222	–53 29 07.44		E	14 19
DW Cen	4747		13 24 25.888	–52 41 44.68		RR	
BR Cen	4643	8260-00741	13 24 39.437	–52 20 01.21	13215–5204	SR	14 19
BS Cen	4644		13 24 47.539	–57 05 25.97		RRAB	2 13 14 19
DX Cen	4748		13 25 28.798	–55 35 47.10	13223–5520		
DY Cen	4749	8662-01814	13 25 34.013	–54 14 43.55	13224–5359	RCB	1 14 18 19 23
DZ Cen	4750		13 25 46.559	–50 40 40.42		SR	
EE Cen	4751	8670-01851	13 27 15.676	–57 58 14.48	13240–5742	SR	14 19
BT Cen	4645		13 27 09.335	–53 59 09.64		RR:	14 19
EF Cen	4752		13 27 18.534	–54 54 04.58		RR:	
EG Cen	4753		13 27 36.783	–51 21 11.64	13245–5105?	M	
EH Cen	4754	8666-00627	13 29 03.929	–54 44 57.08		E*	4 13
EI Cen	4755		13 29 40.578	–55 04 47.67		E*	4 13
EK Cen	4756		13 29 49.095	–58 04 31.93	13265–5749	M:	19
BU Cen	4646	8256-01243	13 29 36.715	–50 00 05.80	F13265–4944	RV:	14 19
EL Cen	4757	8670-00807	13 30 25.222	–56 54 52.56		E	19
EM Cen	4758		13 30 12.821	–49 47 28.83		RRAB	
EN Cen	4759	8666-00104*	13 30 32.016:	–55 08 14.32:		E/SD:	4
EO Cen	4760	8674-00892	13 31 42.524	–58 23 36.84		EA*	13
EP Cen	4761	8670-00160	13 31 46.044	–57 33 46.05		EA*	13
BV Cen	4647	8666-00998	13 31 19.493	–54 58 33.89		UG*	1 4 6 7 11 14 15 18 19 22
EQ Cen	4762	8662-00075	13 32 17.398	–52 32 19.10		RRC	
BW Cen	4648		13 33 01.737	–50 48 44.70	13299–5033	M	*14 19*

Table 1: Positions and identifications in MWF 167

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
ER Cen	4763	8667-02132	13 33 23.246	–55 31 50.61	13301–5516	RR:	
ES Cen	4764		13 33 25.877	–51 52 22.74	13303–5137	M	
BX Cen	4649		13 33 43.946	–50 50 42.97	F13306–5035?	M	14 19
BY Cen	4650		13 33 47.562	–51 15 08.78		M:	
ET Cen	4765	8671-00828	13 34 59.894	–56 51 34.88	13317–5636	M	14 19
EU Cen	4766		13 34 52.748	–51 29 32.00	13317–5114	S:	
BZ Cen	4651		13 36 29.740	–50 51 23.20		RRAB	
EV Cen	4767	8663-01152	13 36 00.424	–53 25 59.50	13328–5310	S:	3
CC Cen	4652	8663-02093	13 37 13.910	–53 43 14.05		M	3
CD Cen	4653		13 37 21.302	–53 48 55.04	13341–5333	M	1 3 *14* 18 *19*
CE Cen	4654		13 37 25.498	–53 36 33.34	13342–5321	M:	3 14 19
EW Cen	4768		13 37 42.583	–52 22 10.20		RR:	
EX Cen	4769		13 38 17.481	–56 00 39.85	13350–5545	M:	
EY Cen	4770	8269-02943*	13 39 16.628	–49 24 58.23		SR	
FF Cen	4771		13 39 46.607	–50 14 58.44	13366–4959		
EZ Cen	4772	8273-01538*	13 39 50.394:	–51 11 00.85:		RRC	
FG Cen	4773		13 40 06.629	–50 17 22.08		RRAB	14 19
FH Cen	4774		13 40 44.207	–51 40 42.87	F13375–5125	M	
CF Cen	4655	8663-01798	13 40 57.850	–52 44 28.61	13377–5229	M:	
FI Cen	4775		13 41 01.050	–52 30 51.25	13378–5215	S:	
FK Cen	4776		13 41 52.950	–56 26 40.92		EA*	13
FL Cen	4777		13 41 51.530	–50 32 41.57	13387–5017	RR:	
FM Cen	4778		13 42 22.204	–50 01 01.16		M:	
FN Cen	4779	8274-01736	13 42 35.503	–51 21 29.56	13394–5106	S:	
FO Cen	4780		13 43 01.981	–52 03 44.92		S:	
FP Cen	4781		13 43 30.725	–52 52 41.04		S:	
FQ Cen	4782		13 43 33.905	–50 24 45.06		RRAB	
FR Cen	4783		13 43 35.301	–49 40 20.71		RR	
CG Cen	4656		13 43 58.816	–55 19 43.10		S:	14 19 20
FS Cen	4784		13 44 07.073	–51 52 08.50		RR	
FT Cen	4785		13 44 17.375	–51 44 00.88		RR	
CH Cen	4657		13 44 33.272	–55 04 15.04		S:	14 19
FU Cen	4786		13 44 40.529	–51 07 02.26		S:	
CI Cen	4658	8270-01156	13 44 41.251	–50 05 01.54		SR	
FV Cen	4787		13 45 05.410	–56 31 39.61		L	
FW Cen	4788	8671-01394	13 45 23.549	–56 21 53.93		E	
FX Cen	4789		13 45 21.386	–53 33 15.70		RR	
FY Cen	4790		13 45 28.463	–52 05 11.78			
FZ Cen	4791		13 46 05.073	–51 52 20.36	F13429–5137	S:	
GG Cen	4792		13 46 01.885	–50 16 07.55		RR:	
GH Cen	4793		13 46 16.782	–51 35 50.66		RR	
GI Cen	4794		13 46 21.089	–51 20 03.23		S:	9 10 17
GK Cen	4795	8270-01131	13 46 20.891	–49 35 50.80		RRAB	
GL Cen	4796		13 47 01.470	–50 50 31.79			
GM Cen	4797	8672-00319	13 47 26.238	–57 26 25.14		S:	*19*
GN Cen	4798		13 47 09.563	–51 45 46.04		S:	*19*
GO Cen	4799		13 47 28.245	–50 37 25.14		RR:	
CK Cen	4659	8672-01508	13 47 49.805	–57 42 12.33	13444–5727	M	14 19
GP Cen	4800		13 47 32.715	–50 57 53.10		E:	
CL Cen	4660	8668-01125	13 48 55.121	–55 07 25.14	13456–5452	SR	19*
GQ Cen	4801		13 48 03.795	–52 10 21.91		S:	
GR Cen	4802		13 48 25.676	–51 05 29.08		RR	
GS Cen	4803	8274-00209	13 49 15.571	–50 58 47.32	F13460–5043	M:	14 19
GT Cen	4804		13 49 24.993	–51 00 28.20			*14 19*
GU Cen	4805		13 49 57.321	–50 48 13.17	13467–5033	RR	
GV Cen	4806	USNO-A1.0	13 50 26.661	–54 34 24.78	13471–5419	L	19*
GW Cen	4807	8270-02295	13 50 22.121	–49 17 41.37		RR	*14 19*
GX Cen	4808	8672-01793*	13 50 54.584	–57 40 23.25		EA*	13
CM Cen	4661	8668-01148	13 51 02.441	–55 33 20.16	13477–5518	M	14 16 19
GY Cen	4809	8274-02238	13 51 03.444	–51 02 06.76		E/SD:	

Table 1: Positions and identifications in MWF 167

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
GZ Cen	4810	8664-01247*	13 51 26.189	–54 01 57.74	13481–5347	S:	
HH Cen	4811	8664-01576	13 51 31.541	–52 30 08.71	13483–5215	S:	
HI Cen	4812		13 51 33.043	–52 06 00.85		RRAB	
HK Cen	4813	8274-02338	13 51 30.398	–51 13 52.68		E/SD:	14 19
HL Cen	4814		13 51 36.182	–51 25 10.57		RR:	
HM Cen	4815		13 51 42.972	–52 13 38.33		M:	
AU Cen	3722	8274-02105	13 51 57.866	–52 22 39.14	13487–5207	M	14 19
HN Cen	4816		13 52 16.796	–51 06 38.95		RR	
HO Cen	4817		13 52 25.734	–51 34 48.59		S:	
HP Cen	4818		13 52 29.478	–51 29 36.64		RRAB	14 19
HQ Cen	4819	8672-02743	13 52 51.230	–56 29 22.60		S:	
HR Cen	4820		13 52 43.152	–51 38 51.70		RR	
HS Cen	4821		13 52 44.520	–52 32 15.81	13495–5217	L:	14 19
HT Cen	4822		13 53 03.308	–51 06 21.72		RRAB	14 19
HU Cen	4823	8271-00285	13 53 35.894	–50 33 03.10		S:	
HV Cen	4824	8672-02248	13 53 57.391	–56 42 47.38		SR	
HW Cen	4825		13 54 17.846	–50 47 58.21		S:	
HX Cen	4826		13 54 57.077	–51 47 14.72	13517–5132	E:	
HY Cen	4827	8672-02649	13 56 55.685	–56 55 28.27	13535–5640	M	
HZ Cen	4828	8664-01500	13 57 10.268	–53 19 09.62		S:	
II Cen	4829		13 57 41.865	–55 52 51.33		E	
IK Cen	4830	8664-00877	13 57 36.586	–52 51 24.62		M:	
IL Cen	4831	8275-00336	13 57 50.584	–52 17 04.36	13545–5202	S:	
IM Cen	4832	8668-00738	13 58 23.486	–55 53 50.46		SR:	
IN Cen	4833	8275-01175	13 59 14.462	–52 10 43.23		E/SD:	
IO Cen	4834		13 59 37.876	–56 08 55.14		M:	
IP Cen	4835	8669-00125	14 00 25.238	–55 40 11.71	13570–5525	M	
IR Cen	4836		14 00 20.338	–52 39 10.13		M:	
IQ Cen	4837	8665-00060	14 00 34.363	–54 16 15.85		EA*	13
IS Cen	4838		14 01 51.718	–55 26 47.30		E	
IT Cen	4839	8669-00814	14 02 54.167	–55 57 36.54		RR	
IU Cen	4840	8673-02093*	14 07 30.980	–56 41 55.13		CEP	13
			Known variables (Prager 1929)				
AG Cen†		8662-01661	13 31 30.149	–54 18 26.96		CST	
RV Cen	91	8671-01707	13 37 36.104	–56 28 35.74	13343–5613	M	5 8 12 18
XX Cen	1301	8671-00086	13 40 18.634	–57 36 47.65	13369–5721	DCEP	8 18
AH Cen†						CST	
AI Cen†		8672-02846	13 54 42.410	–56 24 51.30		CST	

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REMARKS to Table 1:

RV Cen = HD 118322 (Nb) = CPD −55°5650 = CoD −55°5254 = He 3-919 = HIP 66466 = PPM 770881
XX Cen = HD 118769 (G5) = CPD −56°5865 = CoD −56°5061 = 189.1906 = GC 18463 = HIP 66696 = MSX5C G309.4615+04.6361 = PPM 342137 = SAO 241049
AF Cen = 49.1920
AG Cen = CPD −53°5652 = CoD −53°5192 = 50.1920
AH Cen = 51.1920
AI Cen = 52.1920
AU Cen. There is a companion, slightly fainter on GSS (SERC-J) plate 01F7, at $\rho = 6''.98$, $\theta = 89°1$.
BL Cen = V694 Cen = vG 89. Declination in HB 874 is in error by $+10'$.
BM Cen. Type EA/SD. Right Ascension in HB 874 is in error by $-1^{\rm m}$.
BP Cen = CoD −49°7809 = CPD −49°5937. Type EA/SD. Kazanasmas (1964) and Tsesevich & Kazanasmas (1971) both mark two different stars on their charts; BP Cen is the northern star of the two.
BQ Cen = CPD −49°5965
BR Cen = CoD −51°7493 = 2MASSI J1324394–522000 = 2MASSI J1324394–521959 = IRAS F13215–5204
BT Cen = 2MASSI J1327094–535909
BU Cen = CoD −49°7970 = CPD −49°6125 = 2MASSI J1329367–500005
BV Cen = 1ES 1328–54.7 = 1RXS J133118.6–545832 = 2E 1328.1–5442. Type UGSS+E/WD.
BW Cen = IRAS F13299–5033? Bright on DSS2 (UK Schmidt IIIaF) plate A2I0.
BZ Cen. Right Ascension in HB 874 is in error by $-1^{\rm m}$.
CD Cen. Absent from USNO-A2.0.
CF Cen = GSC 8663-01385 (image classified non-stellar).
CG Cen = PK 310 + 6°1 = Wray 16-134
CH Cen. There is a fainter close companion at $\rho = 2''.26$, $\theta = 42°.0$ on GSS (SERC-V) plate 06AI.
CK Cen = MSX5C G310.4310+04.3440
CL Cen. Right Ascension in HB 874 is in error by $-1^{\rm m}$. The chart by Tsesevich & Kazanasmas is inverted, and the field twice the dimensions indicated.
CR Cen. Absent from USNO-A1.0.
CS Cen. GSC image classified nonstellar. Absent from both USNO-A1.0 and USNO-A2.0. USNO-A1.0 0300–17774361 is a companion, fainter on GSS (SERC-V) plate 0615, at $\rho = 2''.05$, $\theta = 311°.9$.
CT Cen = HD 114297 (A3) = CoD −57°4891 = CPD −57°5924 = SA 194-1339. Type EA/DS.
CY Cen. Type EA/SD.
CZ Cen = IRAS F13096–5215
DD Cen. GSC image classified nonstellar. There is a companion, fainter on GSS (SERC-V) plate 0615, at approximately $\rho = 4''.5$, $\theta = 224°$.
DG Cen = He 3-875 = IRAS F13101–5057. Image appears slightly elongated; probably a close double.
DI Cen. Type EA/DM. Absent from USNO-A2.0.
DK Cen. Type EA/DS.
DN Cen. Type EB/SD:.
DP Cen. GSC images, classified nonstellar, refer (as do the USNO-A1.0 and USNO-A2.0 positions) to the light center of a close, blended double with nearly equal components. It is unclear which component is variable. An estimated position for the preceding component is listed in Table 1, with the companion at roughly $\rho = 3''.3$, $\theta = 55°$.
DQ Cen = MSX5C G306.8746+04.4543
DR Cen. The USNO-A1.0 and USNO-A2.0 positions refer to the light center of a close, blended double. It is unclear which component is variable.
An estimated position of the slightly brighter, south-preceding component is listed in Table 1, with its companion at approximately $\rho = 2''.5$, $\theta = 45°$.
DV Cen = 2MASSI J1324193–532906
DW Cen = 2MASSI J1324259–524144
DZ Cen = 2MASSI J1325465–504040
EE Cen = CSS 821 = MSX5C G307.6820+04.5696

EG Cen = 2MASSI J1327367–512111 = IRAS F13245–5105
EH Cen. Type E/SD:.
EI Cen. Type E/SD.
EK Cen = MSX5C G308.0031+04.4169
EN Cen. GSC image, classified nonstellar, refers (as do the USNO-A1.0 and USNO-A2.0 positions) to the light center of a close, blended double with slightly unequal components. We tentatively identify the preceding component, with position estimate in Table 1, as the variable. Its companion, slightly fainter on GSS (SERC-V) plate 0615, lies at approximately $\rho = 1''\!.0$, $\theta = 17°$.
EO Cen = CoD $-57°5052$ = CPD $-57°6101$ = BV 512 = NSV 06286. Type EA/DS.
EP Cen = CoD $-56°4995$. Type EA/SD.
ES Cen = IRAS F13303–5136
EX Cen. Absent from both USNO-A1.0 and USNO-A2.0. USNO-A1.0 0300–19107641 is a close companion, fainter on GSS (SERC-V) plate 06AI, at $\rho = 5''\!.54$, $\theta = 131\overset{\circ}{.}7$.
EY Cen. GSC image classified nonstellar.
EZ Cen. GSC image classified nonstellar; it appears to be a blend (as do the USNO-A1.0 and USNO-A2.0 positions) with a fainter close companion at approximately $\rho = 3''\!.8$, $\theta = 340°$.
FF Cen = IRAS F13366–4959
FK Cen. Type EA/SD.
FL Cen = IRAS F13387–5017
FN Cen = IRAS F13394–5106
FY Cen. Image appears elongated. An unresolved double?
GI Cen = NGC 5286-V1. Type RRab, Max = HJD 2442937.495 + 0.63589 E (Liller, M.H. & Lichten, S.M. 1978, *Astr. J.*, **83**, 41). There is a companion, slightly fainter on GSS (SERC-J) plate 02EX, at $\rho = 4''\!.99$, $\theta = 235\overset{\circ}{.}2$.
GK Cen. GSC image classified nonstellar.
GL Cen. Absent from both USNO-A1.0 and USNO-A2.0. GSC 8274-00687, slightly brighter on GSS (SERC-J) plate 02EX, lies at $\rho = 7''\!.66$, $\theta = 182\overset{\circ}{.}3$.
GM Cen = MSX5C G310.4368+04.6102?
GU Cen = IRAS F13467–5033
GV Cen. Not visible on GSS (SERC-V) plate 06AI. The chart by Tsesevich & Kazanasmas is inverted.
GX Cen. Type EA/SD.
GZ Cen. Absent from both USNO-A1.0 and USNO-A2.0. GSC image classified nonstellar. There is a companion, fainter on GSS (SERC-V) plate 06AI, at approximately $\rho = 3''\!.4$, $\theta = 308°$.
HN Cen. GSC 8274-02224, slightly brighter on GSS (SERC-J) plate 01F7, lies at $\rho = 10''\!.94$, $\theta = 175\overset{\circ}{.}6$.
HO Cen. Absent from both USNO-A1.0 and USNO-A2.0.
HV Cen. Identification by W.P. Bidelman and D.J. MacConnell (1998, *Inf. Bull. Var. Stars*, No. 4612) with IRAS 13506–5627 is incorrect.
IO Cen. Absent from USNO-A1.0.
IP Cen. Absent from both USNO-A1.0 and USNO-A2.0.
IQ Cen. Type EA/SD.
IR Cen. There is a companion, slightly fainter on GSS (SERC-J) plate 01F7, at $\rho = 4''\!.59$, $\theta = 7\overset{\circ}{.}7$.
IU Cen. GSC images classified nonstellar.

Table 2: Positions and identifications in MWF 175

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
RX TrA	5133	9022-01027*	15 33 52.713	–60 49 59.68	15297–6040	M	13 22
RY TrA	5134		15 34 41.175	–61 29 46.13	15305–6119	M	13 22
RZ TrA	5135		15 38 39.763	–60 47 25.60		E/SD:	22
SS TrA	5136	9022-01335	15 39 21.790	–60 53 38.50		EA*	13 19 22
ST TrA	5137		15 39 36.857	–60 35 23.09		SR:	13 22*
WX Nor	5138	8708-01801	15 40 41.813	–58 32 16.66		EA*	16*
WY Nor	5139		15 41 49.094	–58 20 45.08		RR	13 22
WZ Nor	5140	8708-02587	15 41 56.918	–59 08 11.69		EA*	16*
SU TrA	5141	9027-02541	15 43 31.061	–62 47 34.72		S:	*13 22*
XX Nor	5142		15 43 09.427	–58 23 10.98	15390–5813	M:	22
XY Nor	5143	8708-01342	15 43 17.398	–58 19 27.70		EA*	17 22
SV TrA	5144		15 44 29.082	–61 08 54.52		S:	
SW TrA	5145	9027-01277	15 45 13.606	–62 10 41.48	15408–6201	RR:	13 22
SX TrA	5146		15 46 05.361	–60 40 34.73		E/SD:	13 22
SY TrA	5147	9027-03263	15 46 44.686	–62 00 23.74	15424–6151?		22
XZ Nor	5148	8708-01448*	15 46 33.664	–59 41 29.02	15424–5932	M:	13 22
YY Nor	5149	8705-01949	15 47 58.510	–57 24 42.05		EA*	15
SZ TrA	5150		15 48 57.095:	–63 36 39.07:		S:	22
YZ Nor	5151		15 48 37.832	–60 00 54.14		RR	13 22
TT TrA	5152	9027-03751*	15 49 17.328:	–62 56 11.69:		RR:	21 22
ZZ Nor	5153	8709-01629	15 48 48.766	–58 48 27.36	15447–5839	L:	13 22
AA Nor	5154	8705-01858*	15 49 26.189	–57 39 43.39		CEP	16
TU TrA	5155		15 50 07.395	–61 16 37.38	15458–6107	RR:	
TV TrA	5156		15 50 43.807	–61 39 54.48	15463–6130?	RR:	22
TW TrA	5157		15 51 26.231	–63 42 20.94	15470–6333?	SR	13 22
AC Nor	5158	8709-02515	15 51 29.712	–59 25 48.79		EA*	16
TX TrA	5159	9027-05702	15 52 01.272	–62 31 59.74	15476–6223	M	22
TY TrA	5160		15 52 22.719	–63 00 21.85		RR	*13 22*
AD Nor	5161	8709-02778	15 51 58.711	–59 52 28.74	15478–5943	S:	22
TZ TrA	5162	9027-04927	15 52 26.249	–62 35 33.79	15480–6226	M	13 22
UU TrA	5163	9031-00359	15 53 06.791	–63 49 33.67	15486–6340	S:	22
UV TrA	5164		15 52 56.689	–61 14 36.00	15486–6105	S:	13 22
AF Nor	5165	8705-03082	15 52 38.054	–56 38 31.38	S15487–5629	S:	13 22
AG Nor	5166	8705-02542	15 52 37.699	–56 54 00.22	15486–5645	RRAB	13 22
UW TrA	5167	9027-05109	15 53 42.050	–62 39 18.65	15493–6230	S:	*13 22*
AK Nor	5168		15 54 07.995	–59 14 09.28	15500–5905	M:	
AL Nor	5169	8709-03215	15 54 22.841	–59 57 42.88	15501–5948	M	22
UX TrA	5170	9027-05683	15 54 53.309	–62 51 45.04		S:	13 22
UY TrA	5171		15 55 18.663	–62 05 38.04		RR	13 22
AM Nor	5172	8709-02149	15 55 09.286	–59 54 01.76	15509–5945	S:	22
AN Nor	5173		15 55 09.209	–59 52 00.33	15509–5943	M	22
UZ TrA	5174		15 56 28.264	–64 00 07.03		RR	*22*
VV TrA	5175		15 56 07.359	–60 25 18.98		RR:	13 22
AO Nor	5176	8709-01271	15 56 06.166	–59 36 34.38	15519–5927	S:	13 22
AP Nor	5177	8709-02881	15 56 07.238	–59 05 19.97	15519–5856	S:	22
VW TrA	5178	9031-04389	15 57 33.108:	–64 52 54.12:	15529–6444	S:	22
AQ Nor	5179		15 56 54.987	–59 31 15.95		S:	*13 22*
AR Nor	5180	9023-00791	15 57 08.806	–60 04 51.78		S:	*22*
VX TrA	5181	9023-00788	15 57 53.028	–61 09 04.75	15535–6100	S:	22
VY TrA	5182		15 58 31.944	–61 41 20.04		S:	
AT Nor	5183		15 58 04.938	–57 32 05.31		EA*	16
AV Nor	5184	USNO-A1.0	15 58 23.137	–57 50 15.26	15543–5741		13 22
VZ TrA	5185	9027-04218	15 59 08.068	–62 57 25.36		RR	13 22
WW TrA	5186	USNO-A1.0	15 59 01.085	–61 31 53.57	15546–6123	M:	13 22
AW Nor	5187		15 59 10.993	–60 05 21.17	15549–5956	M	13 22
AX Nor	5188		15 59 15.673	–59 06 35.02	15550–5857	RR:	22*
WX TrA	5189	9036-03681	16 00 42.787	–61 21 53.17	15564–6113	S:	
AZ Nor	5190		16 00 23.482	–58 52 27.73	15562–5843	M	22
WY TrA	5191		16 01 00.502	–61 47 11.20	15566–6138	M	13 22
WZ TrA	5192	9044-02629*	16 01 38.813	–65 00 23.17		E/SD:	22

Table 2: Positions and identifications in MWF 175

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
BB Nor	5193		16 00 48.010:	–59 02 57.65:		M:	22
XX TrA	5194		16 01 49.204	–63 26 39.33		SR:	*22*
XY TrA	5195		16 02 52.542:	–64 13 56.55:		E	*13 22*
XZ TrA	5196		16 02 23.067	–61 00 11.13		M:	13 22
BE Nor	5197		16 02 15.295	–58 00 15.19		EA*	16
BF Nor	5198		16 02 42.061	–59 50 50.33		S:	*22*
BG Nor	5199		16 02 59.792	–59 32 51.76		E	*13 22*
BH Nor	5200	8722-01676*	16 03 02.598	–58 23 03.83		EW*	16
YY TrA	5201	USNO-A1.0	16 03 34.265:	–61 37 43.74:		SR:	13 22
YZ TrA	5202		16 05 10.027	–63 18 26.32	16007–6310	M:	22
ZZ TrA	5203		16 05 18.373	–64 05 53.46		SR	22
BK Nor	5204	8722-02292*	16 05 07.235	–58 45 31.41	16009–5837	S:	22
AA TrA	5205	9036-01005	16 05 40.312	–61 36 16.27			13 22
AB TrA	5206		16 06 03.291	–61 43 50.26		SR:	22
BL Nor	5207		16 06 07.952	–59 37 49.74	16019–5929	SR	13 22
BM Nor	5208	8722-02165	16 06 17.345	–59 44 54.35	16020–5936	M	13 22
BN Nor	5209	8722-02960	16 06 29.450	–58 49 16.07			*13 22*
BO Nor	5210	8722-03261	16 06 48.185	–59 34 04.26	16025–5926	S:	13 22
BP Nor	5211		16 07 00.322	–59 48 28.78	16027–5940	L:	
AC TrA	5212		16 07 56.013	–64 25 04.81		S:	13 22
BQ Nor	5213	USNO-A1.0	16 07 07.089	–58 41 16.27			13 22
BR Nor	5214		16 07 12.988	–59 02 52.83		S:	13 22
BS Nor	5215		16 07 45.884	–59 14 02.36		SR:	
BT Nor	5216	8722-01023	16 07 55.450	–58 46 55.88		S:	13 22
AD TrA	5217	9036-00167*	16 08 25.037	–61 40 07.77		E/SD:	13 22
BU Nor	5218	8718-02761	16 08 03.118	–57 24 11.59		S:	
BV Nor	5219	8718-02061	16 08 04.433	–56 27 14.04	16040–5619		
BW Nor	5220	9036-03158	16 08 35.597	–60 10 10.06		E/SD:	13 22
AE TrA	5221		16 09 41.421	–64 45 29.28		RR	13 22
AF TrA	5222		16 08 58.850	–60 20 41.88		RR:	*13 22*
BX Nor	5223		16 08 44.050	–57 44 16.77	16046–5736	M:	13 22
AG TrA	5224	9036-02239	16 09 37.519	–60 27 50.69	16053–6020	M:	13 22
BY Nor	5225		16 10 22.905	–59 42 39.05		RRAB	15
BZ Nor	5226	8722-00298	16 10 25.938	–58 57 29.32	16062–5849	RR	
AH TrA	5227	9040-00632	16 10 59.890:	–62 31 01.27:		E/SD:	22
AI TrA	5228		16 10 49.217	–60 32 27.17		RR:	
CC Nor	5229	8718-00170	16 10 43.612	–57 38 23.55	16066–5730	S:	13 22
CD Nor	5230	8718-00202	16 10 53.788	–57 32 50.94	16067–5725	M	13 22
CE Nor	5231	9036-01042	16 11 13.241	–60 02 20.32		EA*	15
AK TrA	5232		16 11 37.443	–62 31 44.57		M:	22
CG Nor	5233		16 11 15.582	–58 15 39.31		S:	*22*
CF Nor	5234		16 11 30.793	–60 07 53.98		RR	
AL TrA	5235		16 12 01.894	–61 42 32.88	16076–6134	SR	13 22
CH Nor	5236		16 11 24.990	–56 39 09.84		E/SD	*22*
AM TrA	5237	9044-00421*	16 12 35.894	–64 38 36.91	16079–6431		
AN TrA	5238		16 12 32.540	–63 33 53.70		M	
CI Nor	5239		16 12 13.359	–60 04 22.57		RR	*22*
AO TrA	5240	9040-04747*	16 12 42.831	–62 52 56.20		SR	
AP TrA	5241		16 12 41.441	–61 17 20.35		RRAB	13 22
CK Nor	5242	8722-02554	16 12 19.903	–58 09 17.28		M:	13 22
CL Nor	5243	8718-00129	16 12 39.135	–57 58 12.77		EA*	3 16
CM Nor	5244	8722-01018*	16 12 50.346	–58 24 39.36		EA*	3 16
AQ TrA	5245		16 13 37.479	–63 41 47.09		S:	
AR TrA	5246	9040-04267	16 13 59.830	–62 29 34.13		E	22
AS TrA†	5247		16 13 35.093	–60 13 15.49		E*	
Y TrA	2965	9040-01192	16 14 09.245	–62 05 46.18	16097–6158	M	22
AT TrA	5248		16 14 12.224	–62 26 46.35		RR	
CN Nor	5249	8723-00048*	16 13 44.662	–58 30 40.89		SR	5 22
CO Nor	5250		16 14 04.354	–58 55 39.77	16098–5848	SR	13 22
CP Nor	5251	8723-02059	16 14 04.049	–58 18 21.67		EA*	3 15

Table 2: Positions and identifications in MWF 175

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
AU TrA	5252		16 14 39.246	–61 56 00.57		RR	
CQ Nor	5253	8719-02588	16 14 10.219:	–57 30 35.35:	16100–5722	M:	
CR Nor	5254		16 14 17.613	–58 34 43.58	16100–5827	M	
CS Nor	5255	9036-02882	16 15 03.432	–60 10 42.10	16107–6003?	M	3 22
AV TrA	5256		16 15 55.123	–64 51 10.03		RR	
AW TrA	5257		16 15 58.526	–63 14 13.98		RRAB	13 22
AX TrA	5258		16 15 48.367	–61 58 52.67	16113–6151		
CT Nor	5259	8719-01171	16 15 23.878	–58 06 51.48	16112–5759	S:	*22*
CU Nor	5260	8719-02354	16 15 14.611	–56 43 31.51		M:	*13 22*
CV Nor	5261	8719-01491	16 15 22.194	–57 31 53.78		E	
NSV 07552	5262		16 15 36.795	–59 23 58.26			
CW Nor	5263		16 15 23.572	–56 19 39.66	16113–5612	SR	22
AY TrA	5264	9040-03233*	16 16 26.435	–63 02 39.65		E:	
CX Nor	5265		16 15 41.980	–57 22 21.28		E*	16 22
AZ TrA	5266	9040-01165	16 16 27.509	–62 42 23.83		E	
CY Nor	5267		16 16 03.340	–59 53 45.05	16118–5946	SR	12 13 22
CZ Nor	5268		16 16 00.684	–56 58 38.07	16119–5651	M	
DD Nor	5269		16 16 28.038	–60 15 30.91	16121–6008	M:	13 22
DE Nor	5270	8723-01545	16 16 25.796	–59 07 04.98	16122–5859?	S:	3 *22*
BB TrA	5271		16 16 43.688	–60 45 20.58		M:	12 *22*
DF Nor	5272		16 16 33.199	–59 08 53.92		RR	*13 22*
DG Nor	5273		16 16 27.791	–58 16 06.52		S:	13 22
DH Nor	5274	8719-01901	16 16 21.912	–56 37 48.09		I	13 22
DI Nor	5275		16 16 43.283	–59 07 32.98		RR:	
DK Nor	5276		16 16 33.464	–56 33 04.23	16124–5625	M:	22
BC TrA	5277	9041-00380	16 17 30.078	–62 04 59.41		RRAB	
DL Nor	5278	8723-01724	16 17 20.959	–59 25 50.88	16131–5918		3 13 22
DM Nor	5279	8723-01105	16 17 40.778	–58 47 32.82	16134–5840	M	3 13 22
BD TrA	5280		16 18 06.859	–60 57 58.11		SR	
DN Nor	5281		16 17 36.191	–56 19 00.19	16135–5611	L:	13 22
BE TrA	5282	9045-01040*	16 19 01.715	–64 57 46.40	16143–6450	SR:	2 13 22
BF TrA	5283	9041-02377	16 18 48.514	–62 25 47.75	16143–6218	S:	13 22
DO Nor	5284		16 18 11.143	–57 34 52.31		EA*	12 16
BG TrA	5285		16 18 54.887	–61 06 45.03			
BH TrA	5286	9037-02582	16 19 07.034	–61 22 06.85		RR	12
DP Nor	5287	9037-00027	16 18 56.729	–60 18 25.16		S:	*22*
DQ Nor	5288	8723-00735	16 18 55.133	–59 45 56.66		S:	3 13 22
BI TrA	5289		16 19 12.854	–60 54 01.84		RR	13 22
DR Nor	5290		16 18 52.673	–57 43 04.01	16147–5735	M:	13 22
DS Nor	5291	8723-00929	16 19 10.951	–58 48 19.58		SR	3 5
BK TrA	5292		16 19 23.861	–60 44 32.25		RRAB	22
DT Nor	5293	8719-01997	16 19 06.748	–56 42 21.71		S:	13* 22
BL TrA	5294		16 19 58.198	–62 27 45.76	16154–6220	S:	22
BM TrA	5295		16 19 57.340	–61 58 27.12	16155–6151	M	22
DU Nor	5296		16 20 03.624	–60 14 02.24	16157–6006	M	22
BN TrA	5297	9041-02331	16 20 23.866	–62 19 46.27	16159–6212	M	22
DV Nor	5298	8723-01966*	16 20 01.794	–59 24 49.36	16157–5917		3 13 22
DW Nor	5299		16 20 07.611	–59 42 15.81	16158–5935	M	3 13 22
BO TrA	5300	9037-00329	16 20 35.695	–60 39 42.91		S:	13 22
BP TrA	5301		16 20 48.774	–61 14 45.72	16164–6107	M:	12 22
BQ TrA	5302		16 21 24.950	–64 42 16.75		RRAB	22
DX Nor	5303	8723-02012	16 20 35.568	–59 01 16.64		M	*3* 13 22
BR TrA	5304		16 21 30.833	–63 19 40.60	16169–6312		22
BT TrA	5305	9041-02861	16 21 16.873	–62 26 19.30	16167–6219	S:	13 22
BS TrA	5306		16 21 26.568	–62 59 10.73		SR	
DY Nor	5307	8723-01560	16 21 01.927:	–59 18 32.40:		EA*	3 16
DZ Nor	5308		16 21 17.081	–59 27 17.91	16170–5920	M	3 13 22
EE Nor	5309		16 21 15.563	–59 01 33.07		RR	*22*
BU TrA	5310		16 21 46.901	–62 13 22.85		M:	13 22
BV TrA	5311	9037-01515	16 21 32.489	–60 31 27.12		RRAB	3

Table 2: Positions and identifications in MWF 175

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
BW TrA	5312		16 21 55.050	–61 17 50.65	16176–6110?	SR:	13 22
EF Nor	5313	8723-00696	16 21 39.238	–58 41 57.19	16174–5834	M:	
EG Nor†	5314	9037-02327	16 22 11.846	–61 15 54.40	16177–6108	S:	*3*
BX TrA	5315	9037-01334	16 22 03.854	–60 23 03.05		SR:	3 22
EH Nor	5316		16 22 11.352	–60 02 19.86		SR	
BY TrA	5317		16 22 33.913	–60 37 01.74		RR	22
EI Nor	5318		16 22 09.776	–59 36 27.25		RRAB	3 16
EK Nor	5319		16 22 19.975	–59 09 11.74		RRAB	3 16
BZ TrA	5320		16 22 54.724	–62 56 50.76		M	22
EL Nor	5321		16 22 22.004	–58 02 41.22		S:	
CC TrA	5322	9037-00688	16 23 03.473	–61 46 21.32	16185–6139	M	3 12 13 22
EM Nor	5323	8719-01296	16 22 27.116	–56 20 43.31		EW:*	4 16
CD TrA	5324	9045-00673*	16 23 46.938	–63 57 43.77		S:	3 13 22
CE TrA	5325		16 24 47.227	–64 17 39.86		RRAB	
EN Nor	5326		16 23 51.866	–58 36 02.79	16196–5829	S:	13 22
EO Nor	5327	8719-01904	16 23 52.598	–56 47 53.70		EA*	16 22
RT Nor	3284	8723-01591	16 24 18.698	–59 20 38.18	16200–5913	RCB	3 6 8 10 22 23
EP Nor	5328		16 24 36.985	–57 08 57.30			
CF TrA	5329	9041-03151	16 25 32.069	–63 25 49.12	16209–6319	S:	
CG TrA	5330		16 25 28.737	–61 43 57.34	16210–6137	M	22
EQ Nor	5331	8723-00590	16 25 22.207	–58 27 49.64	16211–5820	M	3 22
ER Nor	5332	8723-00641	16 25 43.354	–59 47 34.48		M	3 13 22
CH TrA	5333		16 25 54.999	–60 34 43.89		RR	3
ES Nor	5334		16 25 44.819	–58 43 58.80		E:	22
CI TrA	5335		16 26 22.183	–63 19 00.27		RR	13 22
EU Nor	5336	8723-01502	16 26 22.202	–58 24 16.70		S:	3 22
ET Nor	5337		16 26 34.982	–60 06 32.03		EA*	3 18
EV Nor	5338		16 26 24.362	–58 54 29.40	16221–5847	SR:	3 13 22
CK TrA	5339		16 26 57.822	–61 44 31.75		RR	22
CL TrA	5340		16 27 10.812	–62 52 24.78		E	
EW Nor	5341		16 26 54.542	–58 30 21.90		RR	22
CM TrA	5342	9037-02213	16 27 28.243	–61 15 30.64		E/SD:	
EX Nor	5343	8720-02114	16 26 58.256	–57 09 16.78		EA*	16
EY Nor	5344		16 27 23.617	–60 09 11.54		RR	22
EZ Nor	5345		16 28 01.425	–60 05 32.18	16236–5958	SR:	12
FF Nor	5346	8720-00886	16 27 51.446	–57 21 36.83			13 22
CN TrA	5347	9041-01110	16 28 29.755	–61 55 50.95		RR	
CO TrA	5348		16 28 20.834	–60 20 18.58		RR	13 22
CP TrA	5349		16 28 57.209	–61 58 11.17	16244–6151	SRA	
CQ TrA	5350		16 29 01.859	–63 38 24.23		RR	
FG Nor	5351	8720-01342	16 28 18.398	–57 23 03.44			*13 22*
FH Nor	5352		16 28 38.999	–59 11 16.61		RR	13 22
FI Nor	5353		16 28 46.211	–60 16 48.34	16244–6010	RR:	*13 22*
CR TrA	5354		16 29 26.780	–62 10 54.25	16249–6204	M	3
FL Nor	5355	8716-01342	16 28 35.575	–55 50 05.39	16245–5543	S:	2 4
FK Nor	5356		16 29 07.751	–59 49 14.28		EA*	16 *22*
CS TrA	5357	9045-02316*	16 29 54.275	–64 36 45.34	F16251–6430	E:	22
CT TrA	5358		16 29 21.018	–61 11 02.20		E/SD	13 22
FM Nor	5359	8720-01513*	16 29 10.194	–56 54 02.61	16250–5647	M	2 22
FN Nor	5360	8724-01006	16 29 43.253	–59 43 43.03	16254–5937	M	22
FO Nor	5361	8720-00537*	16 29 51.893:	–57 43 19.53:	16255–5736	S:	
FP Nor	5362		16 29 55.411	–57 52 34.70		L:	
CU TrA	5363	9045-02700	16 31 02.587	–65 02 04.67		RRAB	2
CV TrA	5364	9037-00240	16 30 25.846	–60 31 55.06	16260–6025	RR	1 3
FQ Nor	5365		16 30 10.299	–57 19 52.63		RR:	17
CW TrA	5366	9037-00609	16 30 46.469	–61 42 16.38	16262–6135	RR	
CX TrA	5367		16 31 12.904	–61 22 12.72	16267–6115	M	22
FR Nor	5368	8720-00115	16 30 44.839	–57 53 27.38			13 22
FS Nor	5369	8724-01619	16 31 17.585	–59 59 32.96	16269–5953	M	1 3 22
CY TrA	5370	9037-01910*	16 31 19.126	–60 45 51.61		E/SD:	

Table 2: Positions and identifications in MWF 175

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
CZ TrA	5371	9037-01323	16 31 40.121	–61 39 09.36	16271–6132		3
DD TrA	5372		16 31 48.342	–61 46 37.47	16273–6140	M:	22
DE TrA	5373	9041-00798	16 31 52.673	–62 33 26.82	16273–6227	SR	22
DF TrA	5374		16 31 58.296	–61 07 54.47		S:	
FT Nor	5375	8724-00360*	16 31 39.869	–58 43 35.88	16274–5837		1 3 13 22
FU Nor	5376	8720-00948	16 31 51.766	–57 13 22.26	16276–5706	M	
RY Nor		8724-00241	16 32 04.236	–58 21 13.07	16278–5814	M	1 3 13 22
FV Nor	5377		16 31 50.990	–56 14 57.02	16277–5608	L:	
DG TrA	5378		16 33 16.739	–63 00 53.04		M	
FW Nor	5379		16 32 36.267	–56 59 04.77		EA*	16
FY Nor	5380		16 32 33.928	–56 33 18.15	16284–5626	M:	13 22
FX Nor	5381		16 33 06.987	–59 39 06.14		RRAB	22
DH TrA	5382		16 33 20.626	–61 32 10.35		RR:	
DI TrA	5383	9045-02887	16 33 55.226	–64 34 39.94		RR:	2 3 *22*
DK TrA	5384	9045-02845	16 33 56.904	–64 29 44.88	F16292–6423	S:	
DL TrA	5385		16 33 43.088	–62 14 02.26	16291–6207	M:	
DM TrA	5386	9037-00420	16 33 47.743	–61 39 03.02		S:	3
FZ Nor	5387	8720-01330	16 33 31.409	–57 57 28.62	16293–5751	M:	13 22
GG Nor†	5388		16 34 04.040	–59 05 13.36		SR	
GH Nor	5389	8716-01555*	16 33 44.937	–56 00 14.55	16296–5554		
DN TrA	5390		15 33 53.959	–61 36 53.16		S:	
DO TrA	5391		16 35 57.945	–64 45 10.45	16312–6439	M	2 13 19 22
GI Nor	5392	8720-00732*	16 35 07.098	–57 11 34.33	16309–5705	SR:	13 22
GK Nor	5393	8708-00412	15 34 50.816	–58 23 58.78		EA*	22
DP TrA	5394	9042-02170	16 36 13.169	–63 42 11.70		RR	3 13 22
DQ TrA	5395		16 36 03.371	–61 23 00.95		RR	13 22
DR TrA	5396	9026-05447	15 35 44.467	–61 57 24.91	15315–6147?	M:	13 22
DS TrA	5397	9046-00280	16 37 07.772	–64 17 08.74	16324–6411	RRAB	2 3 13 22
VW Ara	5398		16 35 59.406	–56 37 09.81		EA*	2 16
DT TrA	5399	9046-00467	16 37 32.880	–65 04 41.74	16327–6458	M	2 13 19 22
DU TrA	5400		16 37 08.151	–62 27 27.74		M	3 13 22
VX Ara	5401	8724-01720	16 36 58.459	–59 34 14.20	16326–5928		1
VY Ara	5402		16 36 57.284	–58 46 45.93	16326–5840	M:	
VZ Ara	5403		16 37 29.773	–58 23 51.05		RRAB	1 13 15 22
WW Ara	5404		16 37 56.030	–58 11 34.32		M	13 22
WX Ara	5405		16 37 54.336	–56 33 32.75		M:	13 22
DV TrA	5406	9046-02261	16 39 25.510	–64 31 09.01		SR:	2 3 22
WY Ara	5407		16 38 57.826	–59 36 18.78			13 22
WZ Ara	5408	8720-00834	16 39 09.584	–57 53 36.14		E/DS:	*13 22*
XX Ara	5409	8724-00704	16 39 26.666	–59 31 48.65		EA*	1 16
XY Ara	5410	8720-00662	16 39 13.322	–57 56 10.00		SR	*13 22*
XZ Ara	5411		16 40 06.290	–58 51 38.44		M:	
DW TrA	5412	9042-03122	16 41 01.817	–63 32 33.18		RR	3
YY Ara	5413	8725-01642	16 41 20.568	–59 52 30.32		RV:	1 13 22
DX TrA	5414	9042-00758	16 42 21.066	–62 03 58.21		E	13 22
YZ Ara	5415		16 42 44.600	–60 06 56.10	16383–6001	M	1 13 22
DY TrA	5416		16 44 36.744	–61 34 07.67	F16401–6128?	M:	22
DZ TrA	5417		16 46 01.778	–63 04 50.55		E/SD	*22*
EE TrA	5418	9042-01244	16 46 12.555	–62 20 11.59	16416–6214	S:	3 22
			Known variables (Prager 1930)				
SU Nor		8708-02211	15 44 35.316	–58 53 24.29		EA*	14
SV Nor		8708-01474	15 45 21.890	–59 49 27.66		EW*	14
SZ Nor			15 55 33.140	–56 43 32.26		EA/K	14
S TrA		9044-00358	16 01 10.735	–63 46 34.32	15566–6338	DCEP	7 8 19
RV Nor		8714-00914	16 04 10.224	–56 04 47.75		CEP	14
U TrA		9040-00921	16 07 19.049	–62 54 36.38		CEP*	8 19
RX Nor						CST:	
SS Nor	3959	8723-00573	16 13 21.888	–59 46 56.64	16090–5939	M	3 22

Table 2: Positions and identifications in MWF 175

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
TY Nor		8719-01819	16 14 12.196	–56 50 01.86		EA*	14
TZ Nor		8719-01395*	16 16 07.047	–57 43 30.75		EA*	3 14
RR TrA	3282	9041-01425	16 18 22.783	–62 44 13.34		EA*	22
S Nor		8719-00158	16 18 51.766	–57 53 58.78	16146–5746	DCEP	3 8 9 11 19 20
RS TrA	3283	9037-00275	16 21 58.531	–61 27 08.75	16175–6120	M:	19
UX Nor			16 27 44.774	–56 47 07.52		CWB	2 14
VW Nor		8724-00824	16 31 34.001	–58 34 13.80		RRAB	3 14 21 22
RT TrA	3285	9042-00226	16 34 30.950	–63 07 59.95		CWB	3 6 8 10 19 22
UZ Ara		8720-00482	16 36 53.239	–56 18 23.26		EA*	2 14
Y Ara	3168	8724-01693	16 39 05.532	–59 48 22.57	16347–5942	M	1 13 19 22
R Ara		8720-02094	16 39 44.980	–56 59 40.11		EA*	2 8 19

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REMARKS to Table 2:

R Ara = HD 149730 (B9) = CPD −56°7804 = CoD −56°6482 = 1RXS J163943.2–565928 = 1WGA J1639.7–5659 = 2E 1635.5–5653 = 2RXP J163945.7–565932 = CCDM 16397–5700 A = GC 22364 = HIP 81589 = HJ 4866 A = PPM 345281 = SAO 244037 = TD1 19346. Type EA/DM:.
Y Ara = HD 149554 (Md) = CPD −59°6790 = 153.1908 = PPM 772486
UZ Ara. Type EA/SD:.
VW Ara. Type EA/SD.
WW Ara. Bright on DSS2 (UK Schmidt IIIaF) plate A1T2.
WX Ara. Bright in USNO-A1.0/A2.0.
WY Ara. Absent from both USNO-A1.0 and USNO-A2.0. Extremely faint on GSS (SERC-V) plate 06AH and DSS2 (UK Schmidt IIIaF) plate A1T2.
WZ Ara. The coordinates in IBVS 4347 are incorrect.
XX Ara. Type EA/DS.
XY Ara. The coordinates in IBVS 4347 are incorrect.
YY Ara = CoD −59°6248 = He 3-1232
YZ Ara. Companion, brighter on GSS (SERC-V) plate 06AH, at $\rho = 8.''66$, $\theta = 155.^\circ8$.
S Nor = HR 6062 = HD 146323 (G0p) = CPD −57°7821 = CoD −57°6342 = 2MASSI J1618518–575359 = GC 21898 = HIP 79932 = NGC 6087-155 = PPM 344832 = SAO 243586
RT Nor = CPD −59°6719 = 112.1910 = CSS 2324 = HIP 80365
RV Nor = 55.1920

RX Nor = 57.1920. No identification recorded.
RY Nor = 58.1920
SS Nor = CoD −59°6051 = 2MASSI J1613218–594656
SU Nor. Type EA/SD.
SV Nor. Type EW/KW.
TY Nor = CPD −56°7432 = 2MASSI J1614121–565002. Type EA/SD:.
TZ Nor = 2MASSI J1616070–574330. Type EA/SD:. All three GSC images are classified non-stellar. There is a companion, GSC 8719-00574, slightly fainter on GSS (SERC-V) plate 06AH, at $\rho = 7.''77$, $\theta = 99.°6$.
WX Nor. Type EA/SD. Kruytbosch's charts for WX Nor and WZ Nor have been interchanged. His chart 2 refers to WX Nor.
WZ Nor. Type EA/SD:. Kruytbosch's charts for WX Nor and WZ Nor have been interchanged. His chart 1 refers to WZ Nor.
XX Nor = MSX5C G323.8725–02.6793?
XY Nor. Type EA/DM.
XZ Nor = MSX5C G323.4188–03.9787. GSC image is classified non-stellar.
YY Nor. Type EA/SD.
ZZ Nor = MSX5C G324.1945–03.4644? Absent from USNO-A2.0.
AA Nor. GSC image is classified non-stellar.
AC Nor. Type EA/SD:.
AD Nor = MSX5C G323.8385–04.5466
AF Nor = CSS 2289 = MSX5C G325.9556–02.0994
AG Nor = IRAS S15485–5644 = IRAS S15486–5644 = IRAS S15487–5644 = MSX5C G325.7908–02.2984
AK Nor = MSX5C G324.4559–04.2282
AL Nor = MSX5C G324.0163–04.8055
AM Nor = MSX5C G324.1303–04.8204
AN Nor = MSX5C G324.1524–04.7943
AO Nor = MSX5C G324.4092–04.6742. Absent from USNO-A2.0.
AP Nor = HD 142154 (Ma) = CoD −58°6232 = CPD −58°6466 = IRSV 1552–5856 = MSX5C G324.7477–04.2776 = PPM 772159
AQ Nor. There is a significant discrepancy between the USNO-A1.0, USNO-A2.0, and DSS2 (UK Schmidt IIIaF plate A1AN) positions and that measured on GSS (SERC-V) plate 06Q1, the former positions all lying roughly 2″to the east of the position listed in Table 2.
AT Nor. Type EA/SD:.
AV Nor = MSX5C G325.7853–03.5148
AX Nor = MSX5C G325.0418–04.5546. The chart by Tsesevich & Kazanasmas is inverted.
AZ Nor = MSX5C G325.3068–04.4718. Absent from both USNO-A1.0 and USNO-A2.0.
BB Nor. Bright on DSS2 (UK Schmidt IIIaF) plate A1AN. Scarcely visible on GSS (SERC-V) plate 06Q1. Absent from USNO-A1.0 and USNO-A2.0. USNO-A1.0 0300-25942295 is a companion, brighter on GSS plate 06Q1, at approximately $\rho = 3.''8$, $\theta = 98°$.
BE Nor. Type EA/SD:.
BH Nor. Type EQ/DM:. GSC image is classified non-stellar.
BK Nor = MSX5C G325.8447–04.7898. GSC image is classified non-stellar.
BP Nor. There is a companion, brighter on GSS (SERC-V) plate 06Q1, at $\rho = 9.''50$, $\theta = 258.°2$.
BS Nor. Bright on DSS2 (UK Schmidt IIIaF) plate A1AN. There is a companion, fainter on GSS (SERC-V) plate 06Q1, at $\rho = 9.''22$, $\theta = 218.°6$.
BV Nor = IRSV 1604–5619 = MSX5C G327.6896–03.3479
BW Nor = 2MASSI J1608355–601010
BX Nor = MSX5C G326.8855–04.3540? Bright on DSS2 (UK Schmidt IIIaF) plate A1AN.
BY Nor = 2MASSI J1610228–594239
BZ Nor = 2MASSI J1610259–585729
CC Nor = MSX5C G327.1485–04.4626? The MSX5C source appears coincident with 2MASSI J1610429–573819, for which no optical counterpart is evident. The IRAS source identified with CC Nor may be a blend between this source and 2MASSI J1610419–573826 to the southwest.
CD Nor = 2MASSI J1610537–573250 = 2MASSI J1610531–573246 = MSX5C G327.2285–04.4105?
CE Nor = 2MASSI J1611132–600220. Type EA/DS.
CF Nor = 2MASSI J1611308–600753. Bright in USNO-A1.0/A2.0, where it is blended with a companion, fainter on GSS (SERC-V) plate 06Q1, at $\rho = 4.''67$, $\theta = 215.°3$.
CG Nor = 2MASSI J1611156–581539
CH Nor = 2MASSI J1611249–563910. Absent from both USNO-A1.0 and USNO-A2.0.
CI Nor = 2MASSI J1612133–600423
CK Nor = 2MASSI J1612199–580917
CL Nor = 2MASSI J1612391–575813. Type EA/SD:.
CM Nor = 1RXS J161250.6–582450 = 2MASSI J1612503–582440. Type EA/SD:. GSC image is classified

non-stellar. There are two entries each in USNO-A1.0 and USNO-A2.0, corresponding to POSS fields 0136 and 0137. The entries for field 0136 are blends with a companion, much fainter on GSS (SERC-V) plate 06Q1, at $\rho = 7''\!.51$, $\theta = 293^\circ\!.5$.

CN Nor = 2MASSI J1613446–583041. GSC image is classified as a blend. It consists of CN Nor and GSC 8723-01631, a close companion of nearly equal brightness on GSS (SERC-V) plate 06AH, at $\rho = 5''\!.66$, $\theta = 91^\circ\!.7$. There are two entries each in USNO-A1.0 and USNO-A2.0, corresponding to POSS fields 0136 and 0137. The entries for field 0137 are blends between CN Nor and GSC 8723-01631.

CO Nor = 2MASSI J1614043–585540

CP Nor = 2MASSI J1614040–581821. Type EA/SD.

CQ Nor = 2MASSI J1614102–573035

CR Nor = 2MASSI J1614176–583443. There is a close companion, fainter on GSS (SERC-V) plate 06AH, at $\rho = 7''\!.51$, $\theta = 210^\circ\!.4$.

CS Nor = 2MASSI J1615032–601042 = 2MASSI J1615034–601041

CT Nor = 2MASSI J1615239–580651

CU Nor = 2MASSI J1615145–564331

CV Nor = 2MASSI J1615221–573154 = MSX5C G327.6775–04.8119

CW Nor = 2MASSI J1615235–561939 = MSX5C G328.5153–03.9481

CX Nor = 2MASSI J1615419–572221. Type EB/DS.

CY Nor = 2MASSI J1616033–595345

CZ Nor = 2MASSI J1616006–565838 = MSX5C G328.1252–04.4736?

DD Nor = 2MASSI J1616279–601531

DE Nor = 2MASSI J1616258–590704

DF Nor = 2MASSI J1616331–590853

DG Nor = 2MASSI J1616277–581606

DH Nor = 2MASSI J1616218–563748 = MSX5C G328.4028–04.2589

DI Nor. Not detected in 2MASSI.

DK Nor = 2MASSI J1616334–563304 = MSX5C G328.4763–04.2213. Absent from USNO-A1.0.

DL Nor = 2MASSI J1617209–592550

DM Nor = 2MASSI J1617407–584733 = 2MASSI J1617407–584732

DN Nor = 2MASSI J1617361–561900 = MSX5C G328.7440–04.1542

DO Nor = 2MASSI J1618111–573452 = S 5698. Type EA/SD.

DP Nor = 2MASSI J1618566–601825

DQ Nor = 2MASSI J1618550–594557

DR Nor = 2MASSI J1618526–574304

DS Nor = 2MASSI J1619109–584819

DT Nor = 2MASSI J1619067–564222. Kazanasmas provides two charts, the second of which is incorrect.

DU Nor = 2MASSI J1620035–601402

DV Nor = 2MASSI J1620018–592448. Absent from USNO-A2.0. GSC image is classified non-stellar. There is a close companion, fainter on GSS (SERC-V) plate 06AH, at approximately $\rho = 3''\!.2$, $\theta = 356^\circ$.

DW Nor = 2MASSI J1620075–594215

DX Nor = 2MASSI J1620355–590116

DY Nor = 2MASSI J1621019–591832. Type EA/SD.

DZ Nor = 2MASSI J1621170–592718

EE Nor = 2MASSI J1621155–590133

EF Nor = 2MASSI J1621392–584157

EG Nor. In the constellation Triangulum Australe. The declination in HB 884 is in error by $+1^\circ$.

EI Nor = 2MASSI J1622097–593627. Absent from both USNO-A1.0 and USNO-A2.0.

EK Nor = 2MASSI J1622199–590911

EL Nor = 2MASSI J1622219–580241

EM Nor. Type EW:/KE:. Not detected in 2MASSI.

EN Nor. The GSS image on SERC-V plate 06AH is elongated, probably an unresolved double. The center-of-light coordinates are listed in Table 2, and in USNO-A1.0 and USNO-A2.0.

EO Nor. Type EA/SD:.

ET Nor. Type EA/SD.

EX Nor. Type EA/SD:.

FI Nor. Bright on DSS2 (UK Schmidt IIIaF) plate A1T2. There is a companion, brighter than the variable at minimum on GSS (SERC-V) plate 06AH, at $\rho = 10''\!.12$, $\theta = 12^\circ\!.5$.

FK Nor. Type EA/DS.

FL Nor = MSX5C G330.1683–04.9054?

FM Nor. GSC image is classified non-stellar.

FN Nor. Absent from USNO-A2.0.

FO Nor. GSC image, classified non-stellar, and its USNO-A1.0 and USNO-A2.0 counterparts are blends with a companion, fainter on GSS (SERC-V) plate 06AH, at approximately $\rho = 3''\!.0$, $\theta = 307^\circ$.

FP Nor. There is a companion, brighter on GSS (SERC-V) plate 06AH, at $\rho = 9''.45$, $\theta = 278^\circ.9$.
FT Nor. GSC image classified non-stellar.
FV Nor. Absent from both USNO-A1.0 and USNO-A2.0.
FW Nor. Type EA/SD.
GG Nor = QT Nor = 787.1935 = HV 8903. Absent from both USNO-A1.0 and USNO-A2.0. The declination in HB 884 is in error by -1°.
GH Nor. GSC image classified non-stellar.
GI Nor. Absent from USNO-A2.0. GSC image, classified non-stellar, and its USNO-A1.0 counterpart are blends with a companion, fainter on GSS (SERC-V) plate 06AJ, at $\rho = 5''.51$, $\theta = 88^\circ.0$.
GK Nor. Type EA/SD. The coordinates in HB 884 are corrected in HB 887.
S TrA = HR 5939 = HD 142941 (G5) = CPD -63°3765 = CoD -63°1146 = GC 21470 = HIP 78476 = PPM 361800 = S 5939 = SAO 253377
U TrA = HD 143999 (F5) = CPD -62°5187 = CoD -62°1019 = 2MASSI J1607189–625438 = GC 21614 = HIP 78978 = PPM 361877 = SAO 253430. Type CEP(B).
Y TrA = 2MASSI J1614092–620545 = 113.1907 = CSS 914 = Hen 4-160
RR TrA = CPD -62°5265 = 2MASSI J1618226–624414 = 110.1910. Type EA/SD.
RS TrA = CoD -61°5377 = 111.1910
RT TrA = CPD -62°5377 = 113.1910 = HIP 81157
RX TrA = MSX5C G321.4724–03.9510. GSC image classified non-stellar.
RY TrA = MSX5C G321.1651–04.5456
SS TrA = CPD -60°5965 = CoD -60°5753. Type EA/SD:.
ST TrA. There is a diffuse object (galaxy?), slightly fainter on GSS (SERC-V) plate 06Q1, at $\rho = 4''.43$, $\theta = 187^\circ.3$. The USNO-A1.0 and USNO-A2.0 counterparts may be blends. Tsesevich & Kazanasmas provide two charts; that in Part IV, p. 48 is inverted.
SZ TrA. The USNO-A1.0 and USNO-A2.0 counterparts are blends with a close companion, slightly fainter on GSS (SERC-J) plate 007I, at approximately $\rho = 1''.7$, $\theta = 115^\circ$. It is unclear which of these two components is the variable.
TT TrA. Absent from USNO-A2.0. All four GSC images are classified non-stellar, and are blends of at least two stars, maybe more. There is a close companion, fainter on GSS (SERC-J) plate 007I and DSS2 (UK Schmidt IIIaF) plate A2DN, at approximately $\rho = 6''.3$, $\theta = 202^\circ$. The USNO-A1.0 counterpart refers to a blend of these two components.
UU TrA = IRAS S15486–6340. Elongated image on GSS (SERC-J) plate 00JI. A blended double?
VV TrA. Absent from USNO-A1.0.
WZ TrA. Absent from USNO-A2.0. GSC image classified non-stellar.
XX TrA. GSS image on SERC-J plate 007I is elongated, probably double.
XY TrA. The USNO-A1.0 counterpart appears to be a blend with a companion, fainter on GSS (SERC-J) plate 00JI, at approximately $\rho = 4''.3$, $\theta = 43^\circ$.
YY TrA. Bright on DSS2 (UK Schmidt IIIaF) plate A1AN.
YZ TrA. Absent from USNO-A1.0. Bright on DSS2 (UK Schmidt IIIaF) plate A1AH. There is a companion, brighter on GSS (SERC-J) plate 00JI, at $\rho = 7''.58$, $\theta = 67^\circ.2$.
AB TrA = 1RXS-F J160609.0–614445?
AC TrA = 2MASSI J1607558–642505
AD TrA = 2MASSI J1608248–614008. GSC image classified non-stellar.
AE TrA = 2MASSI J1609413–644530. There is a companion, slightly fainter on GSS (SERC-J) plate 00JI, at $\rho = 10''.58$, $\theta = 152^\circ.4$.
AF TrA = 2MASSI J1608588–602042
AG TrA = 2MASSI J1609374–602751
AH TrA = 2MASSI J1610598–623102
AI TrA = 2MASSI J1610491–603227
AK TrA = 2MASSI J1611373–623146. There are companions, both brighter on GSS (SERC-V) plate 06Q1, at $\rho = 3''.97$, $\theta = 111^\circ.3$, and $\rho = 7''.00$, $\theta = 71^\circ.9$.
AL TrA = 2MASSI J1612017–614233
AM TrA = 2MASSI J1612358–643837. GSC image classified non-stellar.
AN TrA = 2MASSI J1612325–633354. The GSS image on SERC-J plate 00JI is distorted, double?
AO TrA = 2MASSI J1612428–625256. Bright on DSS2 (UK Schmidt IIIaF) plate A1AH. GSC image classified non-stellar.
AP TrA = 2MASSI J1612413–611721
AQ TrA = 2MASSI J1613373–634147 = 2RXP J161338.6–634146
AR TrA = 2MASSI J1613597–622935
AS TrA = 2MASSI J1613350–601316. Type E/KW:. In the constellation Norma. The declination in HB 884 is in error by -1°.
AT TrA. Not detected in 2MASSI. The USNO-A1.0 and USNO-A2.0 counterparts are blends with a companion, fainter on GSS (SERC-V) plate 06Q1, at approximately $\rho = 5''.0$, $\theta = 279^\circ$. The companion cannot be

excluded as the variable.

AU TrA = 2MASSI J1614390–615601

AV TrA = 2MASSI J1615550–645110

AW TrA = 2MASSI J1615584–631415

AX TrA = 2MASSI J1615482–615853

AY TrA = 2MASSI J1616263–630240. GSC image classfied non-stellar. There is a close companion, slightly fainter on DSS2 (UK Schmidt IIIaF) plate A1AH, at $\rho = 5''.67$, $\theta = 177^\circ 8$. It is unclear which component is the variable.

AZ TrA = 2MASSI J1616275–624225

BB TrA = 2MASSI J1616435–604521

BC TrA. Not detected in 2MASSI.

BD TrA = 2MASSI J1618067–605758

BE TrA = 2MASSI J1619017–645746 = IRAS F16143–6450. GSC image classified non-stellar.

BF TrA = 2MASSI J1618485–622546

BG TrA = 2MASSI J1618547–610645

BH TrA = 2MASSI J1619068–612206

BI TrA = 2MASSI J1619127–605402

BK TrA = 2MASSI J1619237–604432. The USNO-A1.0 and USNO-A2.0 positions may be affected by a companion, fainter on GSS (SERC-V) plate 06AH, at approximately $\rho = 3''.5$, $\theta = 142^\circ$.

BL TrA = 2MASSI J1619580–622746

BM TrA = 2MASSI J1619572–615828

BN TrA = 2MASSI J1620237–621946 = 2MASSI J1620238–621946

BO TrA = 2MASSI J1620355–603943

BP TrA = 2MASSI J1620485–611446 = S 5709

BQ TrA = 2MASSI J1621249–644217. Image is elongated on GSS (SERC-J) plate 00JI; probably double. The USNO-A1.0 and USNO-A2.0 counterparts appear to be affected by another companion, fainter on this same GSS plate, at $\rho = 7''.77$, $\theta = 310^\circ.8$.

BR TrA = 2MASSI J1621308–631940

BS TrA = 2MASSI J1621265–625911

BT TrA = 2MASSI J1621167–622620 = 2MASSI J1621168–622618

BU TrA = 2MASSI J1621467–621323. Absent from both USNO-A1.0 and USNO-A2.0.

BV TrA = 2MASSI J1621323–603127

CD TrA. GSC image classified non-stellar. There is a companion, fainter on GSS (SERC-J) plate 00JI, at approximately $\rho = 2''.9$, $\theta = 148^\circ$.

CE TrA. There is a companion, brighter on GSS (SERC-J) plate 00JI, at $\rho = 9''.74$, $\theta = 58^\circ.6$.

CP TrA. There is a companion, brighter on GSS (SERC-V) plate 06AH, at $\rho = 7''.79$, $\theta = 168^\circ.4$.

CS TrA. Absent from USNO-A2.0. Both GSC images are classified non-stellar. There is a companion, slightly fainter on GSS (SERC-J) plate 00JI, at $\rho = 5''.89$, $\theta = 186^\circ.5$, which may affect both GSC and USNO-A1.0 positions. CS TrA is probably the north component of this pair, for which coordinates are listed in Table 2.

CY TrA. GSC image, classified non-stellar, and its USNO-A1.0 and USNO-A2.0 counterparts are blends of two stars. The brighter component is presumed to be the variable. Its companion lies at approximately $\rho = 2''.6$, $\theta = 179^\circ$.

DN TrA. The coordinates in HB 884 are corrected in HB 887.

DO TrA = IRAS F16312–6439

DR TrA. The coordinates in HB 884 are corrected in HB 887.

DS TrA = IRAS F16324–6411

DT TrA = GSC 9046-02360 = IRAS F16327–6458

EE TrA = IRAS F16416–6214?

NSV 07552 = 2MASSI J1615368–592358 = CSV 101561 = P 1073

Table 3: Positions and identifications in MWF 30

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
QR Aql	5419	1050-00182	19 20 38.069	+12 55 55.09			46
KR Aql	5420	1059-02177	19 25 26.976	+09 38 12.16	19230+0932	S:	33 58
KS Aql	5421		19 28 33.363	+13 27 33.54	19262+1321	SR	56
KT Aql	5422	1063-00353	19 29 59.904	+12 19 19.74	19276+1212	M:	54 *58*
NSV 12097	5423		19 30 30.699	+13 17 00.58			
KU Aql			19 31 09.239	+12 26 15.19	19288+1219	M:	54 *58*
	5424†		19 31 19.611	+13 26 32.63			*30*
KV Aql	5425	1064-02160	19 32 03.216	+11 43 31.44	19297+1137	SR	54
KW Aql	5426		19 32 06.092	+13 00 49.13		S:	
NSV 12123	5427	1068-00959	19 32 29.844	+14 42 44.71			
KX Aql	5428		19 33 53.686	+14 17 47.30		UG	3 *8* 11 35 47 60 61
KY Aql	5429	1064-02268	19 33 58.894	+11 44 04.92	19316+1137	L:	27 54
KZ Aql	5430	1056-03943*	19 35 11.001	+09 09 59.25	19327+0903	M	*33 58*
V451 Aql	5431		19 35 35.024	+11 47 16.56	19332+1140	LB	31 34
LL Aql	5432	1060-03287	19 35 44.251	+10 21 16.67	19333+1014	SR	56
LN Aql	5433	1064-04043*	19 36 16.085	+11 53 20.72		RV	54 58
LO Aql	5434	1060-00676*	19 36 28.451	+10 58 13.48	19341+1051	M	33 47 54 58
LP Aql	5435		19 37 50.263	+09 20 13.54		L:	58
LQ Aql	5436	1602-02607	19 37 42.559	+15 38 08.74	19354+1531		54
LS Aql	5437	1064-02144*	19 38 33.569	+12 42 57.86	19362+1236	SRB	33 47 58
LU Aql	5438	1602-02673	19 38 51.996	+15 44 10.32	19365+1537	SRB	9 16 24 48
NSV 12254	5439		19 39 10.653	+08 30 19.16			
LV Aql	5440		19 39 08.465	+12 55 25.22		M:	
LW Aql			19 39 12.704	+12 11 32.65	19368+1204	M	64
LX Aql	5441		19 39 07.850	+14 51 27.49	19368+1444	SRA	33 58
LY Aql	5442		19 39 45.855	+12 39 41.14	19374+1232	M	19
LZ Aql	5443		19 39 45.638	+15 56 11.53	19374+1549	SRA	50
MM Aql	5444	1069-00369	19 40 08.664	+14 45 14.04	19378+1438	SRA	54
MO Aql	5445	1069-01023	19 40 23.498	+14 57 13.82		M	53
MN Aql	5446	1065-00815*	19 40 29.906	+11 44 14.18	19381+1137	LB	33 58
MP Aql	5447		19 40 35.661	+15 10 43.87		M	53
MQ Aql	5448		19 40 55.738	+12 37 10.23		CWB	39 57 58
MR Aql	5449		19 41 10.412	+13 21 25.32		EA*	53
TZ Sge	5450		19 41 01.672	+16 56 20.37	19387+1649	SRD:	33 58
MT Aql	5451		19 42 12.598	+09 41 33.61		S:	
MU Aql		1069-03618	19 42 11.534	+13 20 24.83	19398+1313	M	33 47 58
UU Sge	5452		19 42 10.375	+17 05 14.45		EA*	6 7 32 37 44
MV Aql	5453	1065-00992*	19 42 45.675	+11 32 34.93	19403+1125	SRB	22
MW Aql		1069-03742*	19 42 44.356	+13 34 14.94	19403+1326	M	47 63
NSV 12332	5454		19 42 56.216	+13 21 23.86			
MX Aql	5455		19 43 38.059	+14 03 16.22	19413+1356	M:	
MY Aql	5456		19 43 51.476	+12 07 35.20		RR:	
MZ Aql	5457		19 44 25.486	+15 14 21.96		S:	
NN Aql	5458		19 44 33.639	+15 33 30.15		RRAB	53 57 58
NP Aql			19 45 00.716	+11 45 50.40	19427+1138?	M	64
NQ Aql	5459	1065-02439	19 45 07.097	+12 22 33.06		S:	
NR Aql	5460		19 45 21.535	+09 53 32.07		M	33 58
NS Aql†	5461		19 45 28.711	+14 55 02.86			*50*
NT Aql	5462	1615-00509	19 45 52.006	+15 09 20.23		S:	
NU Aql	5463		19 46 04.263	+11 45 43.10		S:	
NV Aql	5464	1069-02100	19 46 29.338	+13 51 16.85	19441+1343	SRB	33 49 58
NSV 12395	5465	1069-02401*	19 46 43.314	+14 26 23.69	19444+1419		
UV Sge			19 47 00.051	+16 47 15.51	19447+1639	M	47 *66*
NX Aql	5466		19 47 10.980	+13 29 01.34		E/SD:	
NY Aql	5467	1066-01152	19 47 38.390	+12 09 23.87	19452+1201	SRB	33 58
NZ Aql			19 47 52.081	+13 08 38.65	19455+1301	M:	64
OO Aql	5468	1058-00507	19 48 12.648	+09 18 32.22		EW*	2 40 43 47 52
V926 Aql†	5469	1062-00024	19 48 13.432	+09 23 42.66		EA*	20 43 52
OQ Aql	5470	1070-01813	19 48 32.069	+14 56 54.60	19462+1449	SRB	9

Table 3: Positions and identifications in MWF 30

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
UW Sge	5471		19 48 52.965	+17 03 22.93			
OR Aql	5472		19 48 53.365	+16 03 37.72	19466+1556	SRA	8 41 61
OS Aql	5473	1615-02494*	19 49 04.102:	+15 25 26.58:	19467+1517	M	8 33 47 58
OT Aql	5474		19 49 22.727	+16 03 46.31		M	8 41 *61*
OU Aql	5475	1062-00006	19 49 51.662	+09 23 44.77	19474+0916	M	33 58
OV Aql	5476		19 51 08.720	+13 30 59.90			
OW Aql	5477	1615-00966	19 51 21.816	+15 00 11.92	19490+1452	M	33 47 58 61
OX Aql	5478		19 51 24.791	+15 06 41.98	19491+1459	M	33 47 58 61
OY Aql	5479	1066-02970	19 51 57.660	+11 47 08.74			*33* 57 58*
V1053 Aql	5480		19 51 54.266	+15 34 40.31	19496+1526	L	28
OZ Aql	5481	1066-00693	19 52 29.330:	+12 10 14.56:		RRAB	21 33 39 57 58
PQ Aql	5482		19 53 06.609	+12 59 00.85		SR	*21*
PR Aql	5483		19 53 12.544	+14 09 21.94		M:	
PS Aql		1066-01926	19 53 42.806	+12 47 52.19	19513+1239	SR	21* 64
PT Aql	5484		19 53 43.090	+14 41 08.10	19513+1433	M	
PU Aql	5485	1066-00713	19 54 01.826	+13 07 10.74		SRB	
			Known variables (Prager 1931, *et al.*)				
W Sge	1206		19 19 32.416	+17 12 19.03	19172+1706	M	16 *18* 37 47
NSV 11913	1207					I:	
T Sge		1604-01346	19 21 42.058	+17 40 00.41	19194+1734	SRB	16 24 26 47
V448 Aql			19 30 21.725	+10 56 08.53	19280+1049	SRA:	30
V449 Aql†		1067-00835	19 31 22.658	+13 28 06.17	19290+1321	LB	30* 34
SS Aql		1060-00464	19 32 33.497	+10 31 26.58	19301+1024	M	10 63
WY Sge			19 32 43.819	+17 44 55.86		N*	5 12 36 51 62
V1137 Aql		1068-02115	19 33 01.786	+13 44 42.32	19307+1338	SR:	32
EY Aql			19 34 44.603:	+15 01 52.05:		NA	1 3 5 8 12 13 47
V452 Aql		1056-03795	19 37 04.378	+09 12 03.60		M	64
V453 Aql			19 37 48.786	+10 32 58.55	19354+1026	M	23 31 34 53 58
LR Aql			19 37 50.971	+12 47 17.04	19355+1240	M:	47 54 63
RT Aql		1064-03145	19 38 01.606	+11 43 18.37	19356+1136	M	9 14 15 16 24 47
V454 Aql			19 38 25.581	+10 35 42.00		M	63
V1289 Aql			19 38 42.174	+12 16 30.37		NL:	11 63
V536 Aql			19 38 57.414	+10 30 16.82	19365+1023	INT	29 34 37 56* 63
SV Aql		1064-00996	19 39 01.769	+11 56 46.39	19366+1149	M	10 14 47 63
SS Sge			19 39 08.381	+16 42 39.75		N:	4 12
EZ Aql		1056-02077*	19 39 29.679	+08 36 28.78	19370+0829	RVA	38 45 47 54 65
V827 Aql			19 39 50.679	+10 49 40.40	19374+1042	M:	56
V455 Aql			19 40 13.399	+13 03 10.61	19378+1256	M	65
RV Aql		1061-02097	19 40 43.058	+09 55 51.49	19383+0948	M	9 14 16 47 63
MS Aql		1065-03128	19 41 07.128	+11 48 50.04	19387+1141	LB	9 17
NSV 12292			19 41 27.698	+10 22 25.43			65
V828 Aql		1061-00708	19 43 45.456	+10 52 38.39		EA	64
RX Aql			19 45 11.243	+08 26 40.92	19427+0819	M	63
ShV sv†			19 45 24.271	+14 54 48.76		L	50
V457 Aql			19 45 32.778	+12 17 24.77	19431+1210	M	65
V1290 Aql			19 46 31.876	+10 47 03.24		ZAND:	42 63
NSV 12393			19 46 41.411	+10 27 47.92			63
NW Aql			19 47 11.156	+12 29 03.60		M:	63
QU Aql			19 47 32.618	+08 34 44.35	19451+0827	M	64
NSV 12409			19 47 34.632	+09 22 58.45	19451+0915		64
V459 Aql		1062-00502*	19 47 35.964	+09 56 46.72	19452+0949	M	63
KK Aql		1070-01597	19 47 49.044	+14 33 07.56		SRD	9
AB Sge			19 47 43.480	+17 52 23.99		M	47 66
OP Aql†		1058-00287	19 48 08.310	+09 20 45.02		EA*	20 33 43 52 58
RY Aql			19 48 23.022	+11 31 29.89	19460+1123	M	10 47 63
ST Aql			19 49 16.222	+12 22 12.88		M	10 47 63

Table 3: Positions and identifications in MWF 30

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
SW Aql			19 50 40.686	+12 49 12.26	19483+1241	M	10 47 63
SX Aql			19 50 54.939	+13 13 12.41	19485+1305	M	10 47 63
TW Aql	3220	1070-03183	19 51 00.878	+13 58 15.10	19486+1350	SRD	9 59
AI Sge			19 50 58.388	+17 38 56.45	19487+1731	LB	66
NSV 12477		1615-02134	19 51 26.770	+15 44 33.40		E:	66
WY Aql			19 51 42.712	+16 24 59.38	19494+1617	M	8 16 47 52 66
NSV 12487		1058-01877	19 52 04.039	+09 04 26.94		-	
RV Sge			19 51 53.720	+16 57 34.43	19496+1649	M	8 47 66
PP Aql		1066-02208	19 52 46.550	+12 40 09.08		DCEP	54 65
NSV 12521			19 53 29.311	+09 22 12.13	19510+0914		63
V711 Aql			19 53 44.007	+10 59 41.76		EA*	63
RZ Aql		1062-01352	19 53 53.832	+09 39 36.41	19514+0931	M	10 47 63
SW Sge			19 53 38.596	+17 51 52.83	19513+1743	M	47 66
NSV 12531		1062-02573*	19 54 09.820	+10 18 04.06			64
NSV 12542			19 54 33.073:	+08 54 16.82:			65
AO Sge			19 54 18.306	+17 48 17.93	19520+1740	M	47 66
V340 Aql			19 55 56.521	+15 51 08.38		EA*	9 52 66
S Sge		1616-00837	19 56 01.051	+16 38 03.48	19537+1630	DCEP	9 16 25 47 52 55
AS Sge			19 56 38.711	+17 19 39.64		M	28 32 66

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REMARKS to Table 3:

RT Aql = HD 185293 (Md) = BD +11°3919a = CMC 315449 = DO 5989 (M6) = HIP 96580 = IRC +10433 = MSX5C G048.7100–04.7777 = RAFGL 2423
RV Aql = HD 185821 (Md) = BD +9°4205 = 17.1900 = DO 6036 (M4)
RX Aql = 71.1903
RY Aql = 77.1903
RZ Aql = 83.1903
SS Aql = 64.1903
ST Aql = 78.1903
SV Aql = 2MASSI J1939017+115646 = 2MASSI J1939018+115648 = 68.1903 = MSX5C G049.0258–04.8832
SW Aql = 79.1903
SX Aql = 80.1903
TW Aql = HD 353895 (K7) = 17.1910. The coordinates by G. van Biesbroeck & L. Casteels (1914, *Ann. Obs. R. Belgique*, n.s., *Ann. Astr.*, **13**, 281) are incorrect.
WY Aql = 125.1905 = DO 18241 (M3). The USNO-A1.0 and USNO-A2.0 counterparts are blends with a companion, fainter on GSS (Pal-QV) plate 03OV, at $\rho = 7''.92$, $\theta = 336^\circ.4$.
EY Aql = 17.1929 = N Aql 1926 = SVS 202. Absent from USNO-A1.0 and USNO-A2.0. Not detected in 2MASSI. Not visible on GSS (Pal-QV) plate 00J2; position estimated.
EZ Aql = 109.1905 = CMC 917640 = Zi 1762. GSC image classified non-stellar.
KK Aql = HD 353685 (K5) = BD +14°4043 = 310.1930 = CMC 1112149
KR Aql = DO 5718 (M4) = MSX5C G045.3922–03.0606
KS Aql = 2MASSI J1928333+132733 = MSX5C G049.1215–01.9167
KT Aql = MSX5C G048.2890–02.7680
KU Aql = MSX5C G048.5262–02.9603 = Ross 253
KV Aql = MSX5C G048.0050–03.4946. Absent from USNO-A1.0 and USNO-A2.0.

KX Aql = 1RXS-F J193354.0+141748 = 2MASSI J1933536+141748
KY Aql = IRC +10429 = MSX5C G048.2405–03.9046
KZ Aql. Absent from USNO-A1.0 and USNO-A2.0. GSC image (classified non-stellar) is a blend with a companion of nearly equal brightness (on GSS Pal-QV plate 01ZR) at $\rho = 8''.13$, $\theta = 128^\circ.8$.
LL Aql = MSX5C G047.2360–04.9459
LN Aql = 2MASSI J1936160+115320. GSC image (classified nonstellar) and its USNO-A1.0 and USNO-A2.0 counterparts are blends with a companion, fainter on GSS (Pal-QV) plate 00J2, at approximately $\rho = 5''.8$, $\theta = 172^\circ$.
LO Aql = MSX5C G047.8646–04.8075. GSC image classified non-stellar. Absent from USNO-A2.0.
LP Aql. There is a companion, fainter on GSS (Pal-QV) plate 00J2, at $\rho = 6''.29$, $\theta = 284^\circ.3$.
LQ Aql = 2MASSI J1937425+153807 = 2MASSI J1937425+153808 = MSX5C G052.0980–02.8066
LR Aql = 2MASSI J1937509+124717 = 66.1903 = MSX5C G049.6239–04.2228 = Ross 258 = Zi 1753. Absent from USNO-A1.0 and USNO-A2.0.
LS Aql = 2MASSI J1938335+124257 = CMC 1112046 = MSX5C G049.6451–04.4092. GSC image classified non-stellar.
LU Aql = HD 353315 (M2) = BD +15°3891 = DO 17958 (M4) = 2MASSI J1938520+154409 = AGK3 +15°2056 = CMC 512779 = HIP 96637 = IRC +20421 = MSX5C G052.3207–03.0001? = PPM 136690
LV Aql = 2MASSI J1939084+125525 = MSX5C G049.8964–04.4325. Absent from USNO-A1.0 and USNO-A2.0.
LW Aql = 2MASSI J1939126+121132 = 49.1905 = MSX5C G049.2638–04.8025 = Zi 1761
LX Aql = 2MASSI J1939078+145127 = MSX5C G051.5849–03.4859
LY Aql = 2MASSI J1939460+123945 = MSX5C G049.7411–04.6921. Absent from USNO-A1.0 and USNO-A2.0.
LZ Aql = MSX5C G052.6012–03.0894?
MM Aql = 2MASSI J1940085+144511 = MSX5C G051.6146–03.7501
MN Aql = CMC 1018425 = DO 6035 (M3). GSC image classified non-stellar.
MO Aql = MSX5C G051.8188–03.7038
MP Aql = 2MASSI J1940357+151043. There is a close companion, fainter on GSS (Pal-QV) plate 00J2, at $\rho = 3''.70$, $\theta = 280^\circ.8$.
MQ Aql = 2MASSI J1940556+123710. Absent from USNO-A1.0. GSC 1065-02317, fainter on GSS (Pal-QV) plate 00J2, lies at $\rho = 7''.47$, $\theta = 106^\circ.5$.
MR Aql = 2MASSI J1941104+132125. Type EA/SD:.
MS Aql = HD 355662 (M0) = 431.1928 = AGK3 +11°2322 = DO 6052 (M3) = PPM 136770
MU Aql = 2MASSI J1942115+132025 = 2MASSI J1942120+132031 = MSX5C G050.6267–04.8768? = Ross 261
MV Aql = CMC 1018490. Absent from USNO-A2.0. The proper motion of CMC 1018490 is evidently spurious. GSC image (classified non-stellar) and its USNO-A1.0 counterpart are blends with a companion, fainter on GSS (Pal-QV) plate 00J2, at $\rho = 5''.70$, $\theta = 84^\circ.7$, which appears to have been used as the first-epoch position of CMC 1018490.
MW Aql = 2MASSI J1942443+133414 = 70.1903 = MSX5C G050.8934–04.8790? = Zi 1773. Absent from USNO-A1.0 and USNO-A2.0. GSC image classified non-stellar. There is a companion, fainter on GSS (Pal-QV) plate 00J2, at $\rho = 7''.43$, $\theta = 13^\circ.5$.
MX Aql = 2MASSI J1943380+140315 = MSX5C G051.4228–04.8294. Absent from USNO-A1.0 and USNO-A2.0.
MY Aql = 2MASSI J1943514+120734
MZ Aql = 2MASSI J1944255+151421. Absent from USNO-A1.0 and USNO-A2.0. There is a companion, brighter on GSS (Pal-QV) plate 00J2, at $\rho = 5''.73$, $\theta = 321^\circ.4$, which cannot be excluded as the variable.
NN Aql. Not detected in 2MASSI.
NP Aql = 52.1905 = Zi 1779
NQ Aql = 2MASSI J1945071+122232
NS Aql = 2MASSI J1945286+145502 = MSX5C G052.3943–04.7905. Absent from USNO-A1.0 and USNO-A2.0. There are several close companions, all brighter on GSS (Pal-QV) plate 00J2 than NS Aql, two at $\rho = 4''.46$, $\theta = 98^\circ.5$ and approximately $\rho = 5''.3$, $\theta = 344^\circ$, and two brighter yet at $\rho = 7''.35$, $\theta = 63^\circ.6$ and $\rho = 8''.92$, $\theta = 313^\circ.1$.
NT Aql = 2MASSI J1945520+150919 = CMC 1112120 = MSX5C G052.6473–04.7548
NV Aql = 2MASSI J1946293+135116 = CMC 1112128
NW Aql = 2MASSI J1947111+122903 = 75.1903 = Zi 1787
NX Aql = 2MASSI J1947109+132900
NY Aql = CMC 1112145
NZ Aql = 55.1905 = Zi 1798
OO Aql = HD 187183 (G5) = BD +8°4224 = 1RXS J194812.9+091826 = 1WGA J1948.2+0919 = AGK3 +9°2585 = CMC 512949 = PPM 168688 = SAO 125084. Type EW/DW:.
OP Aql = S 10948. Type EA/SD.
OQ Aql = HD 353832 (K5) = DO 18180 (M1)
OR Aql = MSX5C G053.7984–04.9340? Absent from USNO-A1.0 and USNO-A2.0.
OS Aql. Absent from USNO-A1.0. Bright on DSS1 (POSS-I E) plate 08N7; faint on GSS (Pal-QV) plate

03OV. GSC image classified non-stellar. There is a companion, much brighter on GSS plate 03OV, at approximately $\rho = 8''.5$, $\theta = 176°$.

OT Aql. Absent from USNO-A1.0 and USNO-A2.0. Bright on GSS (Pal-QV) plate 03OV. There is a companion, slightly brighter on DSS1 (POSS-I E) plate 08N7, at approximately $\rho = 4''.6$, $\theta = 309°$.

OU Aql = IRAS S19474+0916 = Ross 367

OW Aql = CSS 2815 = Zi 1808

OY Aql. Tsesevich & Kazanasmas provide two charts. The chart in Part I, p. 6 is correct; that in Part II, p. 9 is incorrect.

OZ Aql = CMC 1018784

PP Aql = 114.1905 = CMC 917834 = Zi 1814

PQ Aql = 2MASSI J1953066+125900

PR Aql = 2MASSI J1953126+140922

PS Aql = 2MASSI J1953427+124752 = 56.1905 = Zi 1819. Gessner's chart identifies PS Aql, not PQ Aql as labeled.

PT Aql = 2MASSI J1953428+144107. Absent from USNO-A1.0 and USNO-A2.0. Bright on GSS (Pal-QV) plate 00J2. There is a companion, USNO-A1.0 0975-17241443, at $\rho = 4''.06$, $\theta = 138°.6$, which is not resolved on this GSS plate.

PU Aql = 2MASSI J1954018+130710

QR Aql = MSX5C G047.7436–00.4679

QU Aql = 53.1905 = CSS 1159 = DO 6181 (M2) = Zi 1790

V340 Aql = HD 354142 (F) = 2MASSI J1955564+155107 = 140.1905 = Zi 1837. Type EA/SD. The coordinates quoted by Nesterov, *et al.* (1995) are in error.

V448 Aql = MSX5C G047.1120–03.5073 = P 1821 = Ross 252

V449 Aql = MSX5C G049.04571–02.5139. Hoffmeister's chart identifies V449 Aql, not HV 5424 as labeled.

V451 Aql = MSX5C G048.4773–04.2229 = P 1847

V452 Aql = 48.1905 = Ross 256 = Zi 1747

V453 Aql = P 1858 = Ross 257

V454 Aql = 111.1904 = Zi 1754

V455 Aql = 110.1905 = MSX5C G050.1387–04.5992 = Zi 1768

V457 Aql = 2MASSI J1945327+121724 = 112.1905 = Zi 1780

V459 Aql = 76.1903 = Zi 1793. Absent from USNO-A2.0. GSC image classified non-stellar. There is a companion, slightly fainter on GSS (Pal-QV) plate 00J2, at $\rho = 6''.73$, $\theta = 128°.6$.

V536 Aql = 112.1904 = HH 387 = HRC 294 = Ross 259 = Zi 1758. The chart by Tsesevich & Kazanasmas is rotated, with north at position angle $\sim 30°$.

V711 Aql = 82.1903 = Zi 1818. Type EA/SD.

V827 Aql = P 1874 = Ross 260

V828 Aql = 50.1905 = Zi 1775

V926 Aql = S 5341. Type EA/SD:.

V1053 Aql = CSV 4854 = P 1921

V1137 Aql = 2MASSI J1933017+134442 = CSV 4714 = MSX5C G049.8933–02.7331 = NSV 12135 = P 1834 = RAFGL 2413 = RAFGL 4250 = Ross 254 = S 8114. Absent from USNO-A2.0.

V1289 Aql = 2MASSI J1938421+121630 = 67.1903 = CSV 4758 = Zi 1756

V1290 Aql = 72.1903 = CSV 4809 = Zi 1783. There is a companion, of roughly equal brightness on GSS (Pal-QV) plate 00J2, at $\rho = 9''.31$, $\theta = 137°.6$.

S Sge = 10 Sge = HR 7609 = HD 188727 (G0p) = BD +16°4067 = 2MASSI J1956012+163805 = AGK3 +16°2074 = CMC 513102 = GC 27601 = HIP 98085 = LS II +16°14 = PPM 137241 = SAO 105436 = TD1 25711

T Sge = HD 181903 (Mc) = BD +17°3940 = 2MASSI J1921420+174000 = DO 17675 (M4) = HIP 95173 = IRC +20399 = MSX5C G052.0433+01.5315 = RAFGL 2375

W Sge = HD 181332 (Md) = 46.1906 = DO 17635 (M4) = IRC +20396 = MSX5C G051.3936+01.7702

RV Sge = 126.1905. Absent from USNO-A1.0 and USNO-A2.0. Bright on GSS (Pal-QV) plate 03OV. The coordinates by M. & G. Wolf (1906, *Astr. Nachr.*, **170**, 361) are incorrect; their chart is correct.

SS Sge = 11.1926 = N Sge 1916 = SVS 81. Absent from USNO-A1.0 and USNO-A2.0. Not detected in 2MASSI. 2MASSI J1939077+164239 is a close companion, brighter on GSS (Pal-QV) plate 03OV, at $\rho = 8''.62$, $\theta = 264°.2$. There is a second companion, slightly fainter than SS Sge on this plate, at $\rho = 9''.54$, $\theta = 302°.0$.

SW Sge = 2MASSI J1953385+175152 = 130.1905 = Zi 1822. Bright on DSS2 (POSS-II F) plate A0BL. The image on GSS (Pal-QV) plate 03OV is asymmetric, and may be a blend. The coordinates by M. & G. Wolf (1906, *Astr. Nachr.*, **170**, 361) are incorrect; their chart is correct.

TZ Sge = 2MASSI J1941015+165619 = IRAS S19387+1649. The USNO-A1.0 and USNO-A2.0 positions are blends with a companion, fainter on GSS (Pal-QV) plate 03OV, at approximately $\rho = 3''.6$, $\theta = 53°$.

UU Sge = 2MASSI J1942102+170514 = A 63 = NSV 12320 = PK 53 − 3°1 = S 8314. Type EA/D:/PN.

UV Sge = 2MASSI J1947000+164715 = 117.1905 = Zi 1788

WY Sge = N Sge 1783. Type N+UG:+EA. Not detected in 2MASSI.

AB Sge = 2MASSI J1947434+175224 = 119.1905 = MSX5C G055.2324–03.7837? = Zi 1799
AI Sge = 123.1905 = MSX5C G055.4304–04.5653 = Zi 1807. Absent from USNO-A1.0 and USNO-A2.0.
AO Sge = 2MASSI J1954183+174817 = 132.1905 = Zi 1828
AS Sge = 2MASSI J1956387+171938 = 142.1905 = CSS2 47 = Zi 1839. Absent from USNO-A1.0 and USNO-A2.0.
NSV 11913 = 47.1906 = CSV 4615 = Zi 1659
NSV 12097 = CSV 4695 = P 1825
NSV 12123 = CSV 4707 = P 1832
NSV 12254 = CSV 4760 = P 1868. Absent from USNO-A1.0 and USNO-A2.0.
NSV 12292 = 111.1905 = CSV 8247
NSV 12332 = CSV 4785 = P 1889. Not detected in 2MASSI. The nearby infrared point source IRAS 19405+1313 is identified with a neighboring star, GSC 1069-02566 = 2MASSI J1942511+132103.
NSV 12393 = 73.1903 = CSV 4813 = Zi 1785
NSV 12395 = CSV 4816 = P 1896. Not detected in 2MASSI. GSC image and its counterparts in USNO-A1.0 and USNO-A2.0 are blends with a companion, fainter on GSS (Pal-QV) plate 00J2, at $\rho = 3\farcs99$, $\theta = 180\fdg8$. IRAS 19444+1419, identified in Table 3 with NSV 12395, may instead correspond to a blend of 2MASSI J1946462+142638 and 2MASSI J1946401+142635.
NSV 12409 = 54.1905 = CSV 4817 = Zi 1791
NSV 12477 = 124.1905 = CSV 4845 = Zi 1809
NSV 12487 = HD 187894 (F8) = BD +8°4245 = 1RXS-F J195203.9+090427 = 1WGA J1952.0+0904 = 2RXP J195203.8+090421 = AGK3 +8°2642 = 16.1923 = CSV 101899 = PPM 168834 = SVS 30 = Zi 1810
NSV 12521 = 81.1903 = CSV 4869 = Zi 1817
NSV 12531 = 57.1905 = CSV 4874 = Zi 1824. GSC image classified non-stellar; its position may be slightly affected by two close companions, both fainter on GSS (Pal-QV) plate 00J2, at $\rho = 8\farcs98$, $\theta = 120\fdg7$, and $\rho = 8\farcs70$, $\theta = 248\fdg7$.
NSV 12542 = 115.1905 = CSV 4877 = Zi 1827. Absent from USNO-A1.0.
HV 5424 = P 1828.
ShV sv = 2MASSI J1945242+145449

Table 4: Positions and identifications in MWF 105, 108, and 111

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
V591 Tau	6858	1839-01460	04 47 32.155	+27 41 07.51	04444+2735	LB:	48 63
DS Tau	6859	1843-00937*	04 47 48.591:	+29 25 11.46:	F04446+2919	INST	32 49
AO Tau	6860		04 49 44.573	+28 20 29.19	04466+2815	M	30 45 54 65
V720 Tau	6861	1843-00616	04 52 01.666	+29 00 04.68	04488+2855	LB:	38
AP Tau	6862	1840-00004	04 54 44.705	+26 55 27.16		EA	30 35 65
AQ Tau	6863	1840-01183	04 55 57.931	+27 53 27.85		EA*	12 36 59
V721 Tau	6864	1840-01223	04 56 03.310	+27 35 59.24		IN:	11
BS Tau	6865	1844-00124	04 58 51.379	+28 31 24.42		INS	10 30 65
GZ Aur	6866		05 00 03.086	+30 01 08.03	04568+2956	IN:	19 34 56 63 64 65
V592 Tau	6867	1849-01102	05 01 42.144	+25 15 43.13		EA*	60
OZ Aur	6868	2392-00768	05 02 51.977	+32 29 49.27		IS:	10
V836 Tau	6869	1849-01615	05 03 06.598	+25 23 19.57		BY	*13* 14 34 42 49
CG Aur	6870	1857-00607	05 03 42.612	+29 11 32.03		EA*	4 36
PP Aur	6871	1857-01361	05 04 36.602	+28 41 21.88		L	60
CH Aur	6872		05 05 29.509	+31 35 44.53		EA*	60
PQ Aur	6873	1857-00255	05 06 11.770	+29 18 48.46	05030+2914	SR	60
AR Tau	6874	1853-01564	05 06 16.517	+27 22 16.03	05031+2718	SR	
NSV 01825	6875	2389-00503	05 06 34.058	+30 46 01.10	05033+3042		
V723 Tau	6876		05 06 46.136	+28 35 23.34		EA*	60
NSV 01829†	6877	1853-00383	05 07 00.211	+26 59 17.54			*60 64 65*
	6878†	1857-01149	05 07 35.798	+29 00 16.09	05044+2856	L	*60**
HO Aur	6879	2389-00480	05 07 46.960	+31 20 19.00		IS:	34 60 64 65
NT Aur	6880	1857-00258	05 09 05.287	+29 40 18.98		EA*	60 64 65
NU Aur	6881	1857-00862	05 09 02.268	+28 40 52.64		RRAB	51 60 64 65
NSV 01845	6882	1849-00066	05 09 07.457	+26 08 18.94	05060+2604		
CI Aur	6883	1857-00440	05 09 22.931	+29 27 16.40		EA*	57
BG Aur	6884	1857-00927	05 09 38.467	+28 39 27.32	05064+2835	SRA	
BH Aur	6885	2397-00244	05 12 04.284	+33 57 47.05		RRAB	8 9 15 50 54 60 64 65
CL Aur	6886	2393-01455	05 12 54.194	+33 30 28.44		EA*	12 36
NSV 01869	6887		05 12 46.904	+29 38 59.69			
DW Aur	6888		05 14 25.836	+30 01 02.42		L	25 30
NSV 01896	6889		05 16 09.238	+31 26 03.50			
NSV 01894	6890	1850-01493	05 16 01.087	+25 18 05.62			
PW Aur	6891	2390-01601	05 18 27.425	+30 08 50.06	05152+3005	IS	19 34 63 64 65
NSV 01930	6892	1859-00031	05 20 21.204	+29 44 23.68			
NSV 01942	6893	1859-01054	05 21 51.451	+28 38 42.14			
NSV 01949	6894		05 22 45.710	+29 07 04.38		S	
NSV 01968	6895		05 25 20.539	+29 45 36.89		E:	
NSV 01885	6896	1287-00775	05 15 07.642	+18 22 29.17	05121+1819		
NSV 01886	6897	1846-00442	05 15 29.153	+22 42 08.46			
NSV 01890	6898	1287-01118	05 15 41.148	+18 40 37.70			
NSV 01919	6899	1851-00408	05 19 01.997	+24 45 49.14	05159+2442		
NSV 01932	6900	1304-00869	05 20 09.605	+19 28 48.86	05172+1925		64 65
NSV 01931	6901		05 20 06.232	+17 28 47.26			
NSV 01958	6902	1847-01162	05 24 49.385	+23 06 06.34	05217+2303		
NSV 01973	6903	1308-00319	05 25 43.133	+20 37 59.59	05227+2035		
NSV 01976	6904	1304-00301	05 26 10.574	+19 08 15.50	05232+1905		
NSV 01981	6905	1300-01241	05 26 24.646	+18 15 58.97			
NSV 01987	6906	1300-00116	05 27 06.487	+16 56 11.40			
NSV 02026	6907		05 29 58.842	+18 48 09.32			
NSV 02059	6908		05 31 14.053	+19 29 39.96			
NSV 02118	6909	1852-00047	05 33 29.160	+24 27 01.02	05304+2425		
NSV 02134	6910	1301-00547	05 33 35.242	+18 20 56.06	05306+1818		
NSV 02181	6911	1301-01765	05 34 41.186	+17 53 18.12	05317+1751		
NSV 02249	6912	1861-00678	05 35 33.847	+23 53 18.17	05325+2351		
NSV 02302	6913	1865-00665*	05 35 55.300	+25 18 27.99			
NSV 02442	6914		05 37 26.660	+22 20 31.09			

Table 4: Positions and identifications in MWF 105, 108, and 111

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
DW Tau	6915		05 37 44.065	+17 45 29.51	05348+1743	M	27
GP Tau	6916	1865-00928	05 38 32.645	+25 00 06.73	05354+2458	SRB	
BV Tau	6917	1861-01567	05 38 34.745	+22 54 44.71		EB*	
NSV 02520	6918	1306-01245	05 39 34.860	+18 52 38.32	05366+1851		
GQ Tau	6919	1865-01967	05 41 34.963	+25 59 52.91		EA*	
EF Tau	6920	1306-01298	05 43 31.805	+19 25 11.93		DCEP	27 51 64 65
V961 Tau	6921	1311-01681	05 44 26.170	+21 53 18.49	05414+2152	LB	20
EG Tau	6922	1303-00352	05 45 43.913	+18 38 15.72	05428+1837	LB	27
EI Tau	6923	1303-01131	05 46 56.534	+17 54 31.57	05440+1753	SRA	27
AX Tau	6924	1862-02035	05 49 43.526	+24 06 55.91	05466+2406	SRA	26
			Suspected variables				
GY Aur		2387-01008	04 56 48.602	+30 35 36.46		EA	*14* 28 36 60
NSV 01785		2388-00793	04 58 09.814	+31 08 46.86			
NSV 01812†		2392-00529	05 03 58.529	+33 01 34.10	S05006+3257		*36*
NSV 01813		1857-00560	05 03 54.190	+29 49 04.22		-	
PS Aur		2393-01219	05 11 04.051	+32 18 05.72		IS	11 36 60
NSV 01914			05 18 40.129	+32 42 03.67	05154+3238	-	
NSV 01916		1859-00532	05 18 55.284	+29 38 21.01			
NSV 01924			05 19 56.693	+27 59 41.04		-	
NSV 01933		1855-00004	05 20 26.474	+28 04 15.92		-	
NSV 01935		1859-01093	05 20 35.465	+28 58 47.89		E:	
NSV 01954			05 24 13.994	+32 27 44.89		-	
NSV 01961		2407-00550*	05 25 01.908	+33 08 34.01		-	
NSV 01900		1287-01111	05 16 12.835	+18 40 58.26	05132+1837		
NSV 01979		1308-01847	05 26 24.794	+22 02 03.12			
NSV 01995			05 27 50.755	+22 59 22.28			
NSV 02365		1302-01161	05 36 07.589	+17 51 49.86	05331+1749	-	
NSV 02419		1861-00908	05 36 54.122	+23 34 08.18			
NSV 02542		1302-00735	05 40 26.928	+17 52 38.28		-	
HY Tau		1306-00895	05 43 22.368	+19 24 05.22		EA	27 41 64 65
NSV 02662		1862-00287	05 50 40.666	+22 41 46.79		-	
			Known variables (Prager 1934, *et al.*)				
RV Tau		1835-01075	04 47 06.742	+26 10 45.19	04440+2605	RVB	4 6 44 54
TT Tau		1843-00772	04 51 31.262	+28 31 36.88	04483+2826	SRB	9 15 54
UY Aur		2387-00982	04 51 47.371	+30 47 13.88	04486+3042	INT	19 34 36 49 54 63
AB Aur	3554	2387-00812*	04 55 45.809	+30 33 04.45	04525+3028	INA	4 9 22 32 54 56 63
SU Aur	2928	2387-00977*	04 55 59.345	+30 34 02.15	04528+3029	INSB	4 8 9 22 32 36 47 49 54 56 63
AM Aur		2391-00611	04 56 36.974	+32 12 10.73		EA*	4 36 56 58
UW Tau		1836-00589	04 57 20.885	+25 37 44.18	04542+2533	LB	43
BE Aur		1844-00677	04 59 39.948	+29 58 26.69		EA	23 56
DG Aur		2392-00156	05 01 33.562	+32 34 01.81		INSA	23 63
Kur sv†		2392-00021	05 03 43.525	+33 02 40.86		E:	36
RT Tau		1845-02557	05 04 13.987	+23 38 50.50		CST	4
VZ Tau	3776	1294-01494	05 05 14.246	+21 45 49.43		ISB	30 62 65
Ts 492†		1853-00578*	05 07 00.948	+26 56 36.21			60 64 65
PR Aur†			05 07 34.470	+28 59 47.23		L	60
DN Aur		2393-00331*	05 07 59.930	+33 23 51.87		RRC	23 50 60 64 65
RW Aur		2389-00955	05 07 49.518	+30 24 05.54	05046+3020	INT	6 8 9 15 33 37 46 49 54 61 63
WX Tau		1294-01484	05 08 16.843	+21 56 43.69	05052+2152	M	69
DP Aur		2389-00962	05 09 27.306	+30 23 21.79	05062+3019	M	23
DQ Aur		2397-01092	05 09 59.693	+34 28 44.83	05066+3425	LB	23

Table 4: Positions and identifications in MWF 105, 108, and 111

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
DT Aur		2393-00867	05 10 32.316	+32 10 42.82	05072+3207	M	10 23 36
DU Aur			05 11 14.537	+31 19 49.23	05080+3116	M	25 30 36
DV Aur		2397-01322	05 13 20.712	+34 37 04.91	05100+3433	SRA	23
AS Tau		1854-00033	05 14 28.510	+27 43 25.00		EA*	55 56 60
EN Aur		2394-01897*	05 15 08.834	+33 44 32.11	05118+3341	LB	10 36 55
AE Aur		2398-00894	05 16 18.206	+34 18 43.99	S05129+3415	INA	4 9 54 61 68
BI Aur			05 16 37.611	+29 52 08.45	05134+2948	M	23
DX Aur		2398-01138	05 18 05.371	+33 46 49.12	05147+3343	SRA	23
AR Aur		2398-01311	05 18 18.914	+33 46 03.00		EA*	9 54 61 68
XX Tau			05 19 24.467	+16 43 01.02		NA	2 7 9 52 54
UV Aur	3322	2394-00373*	05 21 48.930	+32 30 40.98	05185+3227	M	1 8 9 15 36 54
EG Aur		2407-00916	05 26 51.442	+32 03 10.19	05236+3200	SRB	11 23 36
S Aur		2411-00222	05 27 07.428	+34 08 59.24	05238+3406	SR	4 16 39 54
T Aur			05 31 59.139	+30 26 44.95		NB*	2 7 9 21 29 31 54 66 67
AL Tau		1852-00675	05 33 54.844	+26 01 01.56		EA	23
AD Tau		1852-00387	05 34 16.963	+25 36 16.29	05311+2534	I	54 55
AE Tau		1852-00671*	05 34 36.705	+26 12 07.72		CEP	23 51
RR Tau		1869-00335	05 39 30.530	+26 22 26.36	05363+2620	INSA	5 18 22 34 37 53 54 61
AT Tau		1869-01345	05 39 55.682	+27 51 05.36	05367+2749	LB	24
AW Aur			05 40 00.698	+28 42 48.79	05368+2841	M	36 54 55
AB Tau		1869-01391	05 41 02.479	+28 06 23.08	05378+2804	SRA	8 9 15 54
AU Tau		1874-00617	05 43 31.027	+28 07 43.93		SRA	23 60
TU Tau		1866-02572	05 45 13.745	+24 25 12.40	05421+2424	SRB	9 15 54
Y Tau		1311-03045	05 45 39.384	+20 41 42.32	05426+2040	SRB	9 17 54
SU Tau	3089		05 49 03.724	+19 04 21.77	05461+1903	RCB	3 *15* 54 56 70
AY Tau		1866-01969	05 49 48.823	+25 25 24.46	05467+2524	LB	24
BB Tau		1867-02497*	05 52 18.620	+25 49 42.02	05492+2549	LB	24
BC Tau		1863-00151	05 52 58.817	+24 14 30.23	05499+2413	LB	24
BD Tau		1863-00969	05 53 41.410	+23 51 42.84	05506+2351	LB	24 40

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REMARKS to Table 4:

S Aur = HD 35556 (Nb) = BD +34°1044 = 2MASSI J0527074+340859 = Case 10 = CCDM J05270+3409 A = CCS 336 = CMC 904182 = FuenC 49 = IDS 05205+3405 A = IRC +30114 = MSX5C G173.4867–00.5118 = RAFGL 748

T Aur = HR 1841 = HD 36294 (Pec) = BD +30°923a = 2MASSI J0531591+302644 = N Aur 1891 = Wack 507. Type NB+EA.

RW Aur = HD 240764 (G0) = BD +30°792 = 1RXH J050749.3+302406 = 1RXH J050749.3+302409 = 1RXH J050749.4+302406 = 1RXH J050749.5+302407 = 1RXH J050749.5+302408 = 1RXS-F J050746.3+302419 = AGK3 +30°486 = 27.1906 = CCDM 05078+3024 A = CMC 903924 = HIP 23873 = HRC 80 = IDS 05014+3016 A = PPM 69942

SU Aur = HD 282624 (G0) = BD +30°743 = 1RXS J045600.1+303400 = 1WGA J0455,9+3033 = 1WGA J0455.9+3034 = 2E 0452.7+3029 = 2MASSI J0455593+303401 = 2RXP J045559.6+303358 = AGK3 +30°464 = 76.1907 = HIP 22925 = HRC 79 = PPM 69760 = SAO 057509 = SSV LDN 1517-2.

GSC image is classified as non-stellar.

UV Aur = HD 34842 (Pec) = BD +32°957 = 2MASSI J0521490+323037 = ADS 3934 A = AGK3 +32°505 = 58.1911 = Case 9 = CCDM 05218+3231 A = CCS 318 = CMC 503377 = DO 11210 (R?) = FuenC 29 = HIP 25050 = IRC +30110 = Lee 179 = MSX5C G174.2191–02.3493 = PPM 70251 = RAFGL 735 = SAO 057941. GSC image is classified non-stellar.

UY Aur = 2MASSI J0451473+304713 = 3.1913 = CCDM 04518+3047 A = CMC 903705 = HH 386 = HRC 76 = IDS 04454+3037 A

AB Aur = HD 31293 (A0) = BD +30°7461 = 1WGA J0455.7+3032 = 2MASSI J0455458+303303 = 2MASSI J0455458+303304 = 2RXP J045546.6+303258 = AGK3 +30°462 = AFGL 5130 = CMC 804771 = FM 5 = GC 5998 = HIP 22910 = HRC 78 = IRAS S04525+3028 = MWC 93 = PPM 69756 = RAFGL 5130 = SAO 057506 = SSV LDN 1517-1 = TD1 3698 = VdB 31. GSC image is classified non-stellar.

AE Aur = HR 1712 = HD 34078 (B0p) = BD +34°980 = 1RXS-F J051621.2+341903? = 1WGA J0516.3+3418 = 2MASSI J0516181+341844 = 2RXP J051618.7+341844 = ADS 3843 A = AGK3 +34°542 = CCDM 05163+3419 A = Cel 587 = CMC 805069 = GC 6429 = HIP 24575 = IRAS S05130+3415 = LS V +34°3 = MCW 290 = PPM 70112 = SAO 057816 = SEI 136 A = TD1 4252 = VdB 34

AM Aur = HD 282585 (F0) = BD +31°832 = 2MASSI J0456369+321210 = AGK3 +32°463 = 425.1928 = CMC 903774 = PPM 69768 = SAO 057516. Type EA/DS:.

AR Aur = 17 Aur = HR 1728 = HD 34364 (B9) = BD +33°1002 = 1WGA J0518.3+3346 = 2MASSI J0518189+334602 = 2RXP J051819.0+334600 = AGK3 +33°490 = Cel 595 = GC 6476 = HIP 24740 = PPM 70158 = SAO 057858 = TD1 4315. Type EA/DM.

AW Aur = 2MASSI J0540006+284248 = D75 28 = IRAS S05368+2841 = IRC +30123 = MSX5C G179.5430–01.1616 = PEP 18 = RAFGL 5160 = SVS 333

BE Aur = 2MASSI J0459399+295827 = 110.1931 = P 147

BG Aur = 2MASSI J0509385+283928

BH Aur = CMC 805010 = HIP 24226

BI Aur = 2MASSI J0516375+295208 = 117.1931 = P 173. Absent from USNO-A1.0 and USNO-A2.0.

CG Aur = HD 282898 (A7) = CMC 903872 = HV 6870 = P 2671. Type EA/DM.

CH Aur = P 2675. Type EA/SD.

CI Aur = 2MASSI J0509229+292716 = P 2692. Type EA/SD.

CL Aur = CMC 1005693 = P 2699. Type EA/SD.

DG Aur = 112.1931 = P 150

DN Aur = CMC 1005608 = 113.1931 = P 156. GSC image is classified non-stellar. There is a companion, fainter on GSS (Pal-QV) plate 004B, at $\rho = 5''.81$, $\theta = 42^\circ.4$.

DP Aur = 323.1930 = P 161

DQ Aur = 2MASSI J0509596+342840 = 324.1930 = DO 11083 (M5) = MSX5C G171.1836–03.2164? = P 163

DT Aur = 2MASSI J0510321+321041 = 325.1930 = MSX5C G173.1097–04.4849 = P 167

DU Aur = P 168 = Ross 155

DV Aur = 326.1930 = MSX5C G171.4780–02.5769 = P 169

DW Aur = 2MASSI J0514258+300102 = 38.1936 = P 2704

DX Aur = 2MASSI J0518053+334648 = 118.1931 = P 176

EG Aur = 2MASSI J0526514+320310 = 328.1930 = CMC 1005884 = IRC +30113 = MSX5C G175.1962–01.7263? = P 184 = RAFGL 4414S

EN Aur = 2MASSI J0515089+334427 = 606.1936 = CMC 904025 = DO 11141 (M3) = MSX5C G172.4082–02.7853 = P 172 = SVS 330. GSC image is classified non-stellar.

GY Aur = 1WGA J0456.8+3035 = 2MASSI J0456485+303536 = CMC 903778 = CSV 100423 = P 2657

GZ Aur = 2MASSI J0500031+300107 = CSV 471 = P 2662 = PEP 3

HO Aur = 1RXS-F J050747.1+312028 = CMC 903923 = CSV 495 = P 2687 = SS 25

NT Aur = 2MASSI J0509053+294019 = CSV 499 = P 2688. Type EA/SD.

NU Aur = 2MASSI J0509023+284052 = CSV 501 = P 2689

OZ Aur = CSV 478 = P 2665

PP Aur = 2MASSI J0504366+284121 = CSV 484 = P 2673

PQ Aur = 2MASSI J0506117+291848 = CSV 487 = P 2679

PR Aur = 2MASSI J0507345+285947

PS Aur = CMC 1005660 = CSV 506 = P 2697

PW Aur = 1RXS-F J051827.4+300850 = 2MASSI J0518274+300849 = CSV 528 = P 2714

Y Tau = HR 1977 = HD 38307 (Nb) = BD +20°1083 = 2MASSI J0545394+204139 = AGK3 +20°553 = Case 507 = CCS 393 = DO 11544 (N) = GB6 J054542.3+204220? = HIP 27181 = IRC +20121 = Lee 30 = MSX5C G187.0526–04.2758 = PPM 94811 = RAFGL 5168 = SAO 077516

RR Tau = BD +26°887a = 2MASSI J0539305+262226 = AAO +26°121 = 6.1900 = AS 103 = CMC 1101840 = FMC 11 = HRC 170 = IRAS S05363+2620 = IRAS S05364+2619? = LkHα 206 = MSX5C G18.4667–02.4985. Absent from USNO-A1.0 and USNO-A2.0.

RT Tau = HD 285122 (A0) = 2MASSI J0504139+233850 = AGK3 +23°475 = 2.1904 = GJTGTZ 55285 = GJTR 2275 = NGC 1746-Cuf 32 = PPM 94025 = SAO 076934 = SChM 56 = TZS98 346

RV Tau = HD 283868 (K0) = BD +25°732 = 2MASSI J0447067+261045 = AGK3 +26°443 = 45.1905 = CMC 903634 = DO 10741 (K5) = Elia 3-20 = IRAS F04440+2605 = PPM 93762

SU Tau = HD 247925 (G0) = 2MASSI J0549037+190421 = 47.1908 = IRAS S05460+1903 = IRAS S05461+1903 = MSX5C G188.8603–04.4226. The identification in the *Hipparcos Input Catalogue* (HIC 27465) is incorrect.

TT Tau = HD 30755 (Nb) = BD +28°707 = 2MASSI J0451312+283137 = AGK3 +28°462 = CCS 254 = CMC 903694 = DO 10805 (N) = HIP 22578 = IRC +30098 = Kiso C2-2 = Lee 172 = PPM 93827 = RAFGL 639 = SAO 076788

TU Tau = HD 38218 (Nb) = BD +24°943 = 2MASSI J0545137+242512 = AGK3 +24°542 = Case 11 = CCS 390 = DO 11540 (N) = FuenC 100 = HIP 27135 = IRC +20120 = Kiso C2-57 = MSX5C G183.8099–02.4272 = RAFGL 812 = SAO 077502

UW Tau = 2MASSI J0457208+253744 = 23.1916 = CCS 3246 = DO 10902 (M0) = Kiso C2-6

VZ Tau = 2MASSI J0505142+214549

WX Tau = 2MASSI J0508168+215643 = 121.1925 = IRAS F05052+2152 = SVS 66

XX Tau = 100.1927 = N Tau 1927. Not detected in 2MASSI.

AB Tau = HD 246162 (M3) = BD +28°847 = 2MASSI J0541024+280623 = AGK3 +28°536 = 5.1932 = DO 11464 (M6) = HIP 26754 = IRC +30125 = MSX5C G180.1777–01.2914 = PPM 94661 = RAFGL 800

AD Tau = CMC 1101785 = MSX5C G181.4886–03.9035 = SVS 331. Not detected in 2MASSI.

AE Tau = 2MASSI J0534366+261208 = 120.1931 = CMC 1101788. Misidentified as GSC 1852-00707 in SIMBAD. Both GSC images of AE Tau are classified non-stellar. There is a companion, fainter on GSS (Pal-QV) plate 000M, at $\rho = 8.''49$, $\theta = 249.^\circ1$.

AL Tau = 2MASSI J0533548+260101 = 329.1930 = P 193. The identification in the *Carlsberg Meridian Catalogue*, **11** (CMC 1101779) is incorrect.

AO Tau = 2MASSI J0449445+282029 = IRAS F04466+2815

AP Tau = 2MASSI J0454447+265527

AQ Tau = 2MASSI J0455579+275328 = CMC 903765. Type EA/SD:.

AR Tau = 2MASSI J0506165+272215

AS Tau = 2MASSI J0514284+274324 = CMC 1005713 = P 170 = SVS 329. Type EA/SD.

AT Tau = 2MASSI J0539556+275105 = 121.1931 = IRAS S05367+2749 = MSX5C G180.2641–01.6351 = P 301

AU Tau = 2MASSI J0543310+280744 = 330.1930 = CMC 1101872 = MSX5C G180.4451–00.8154? = P 318

AX Tau = 2MASSI J0549435+240655 = 44.1936 = MSX5C G184.6016–01.7072

AY Tau = 123.1931 = MSX5C G183.4884–01.0184 = P 326

BB Tau = 125.1931 = CMC 904591 = CSS 165 = MSX5C G183.4286–00.3275 = P 330. Both GSC images are classified non-stellar. There is a companion, fainter on GSS (Pal-QV) plate 000M, at $\rho = 10.''71$, $\theta = 58.^\circ8$.

BC Tau = 2MASSI J0552587+241430 = 2MASSI J0552588+241431 = 126.1931 = GLMP 132 = MSX5C G184.8717–01.0044 = P 333 = PCC93 86 = RAFGL 5171 = ZOAG 184.95–00.85 = ZPT98 184.96–00.85

BD Tau = 2MASSI J0553413+235143 = 2MASSI J0553414+235145 = 127.1931 = CMC 1006242 = MSX5C G185.2810–01.0573 = P 335

BS Tau = 2MASSI J0458514+283124 = P 2660

BV Tau = 2MASSI J0538347+225444 = CMC 1101828 = P 2769. Type EB/KE:.

DS Tau = 1RXS-F J044751.2+292508 = 2MASSI J0447485+292511 = CMC 903647 = HRC 75 = MHα 259-2 = P 2641. The GSC image (classified non-stellar) and USNO-A1.0 and USNO-A2.0 counterparts are blends with a companion, fainter on GSS (Pal-QV) plate 02TR, at approximately $\rho = 7.''4$, $\theta = 298^\circ$.

DW Tau = 2MASSI J0537440+174529 = P 2766

EF Tau = 2MASSI J0543317+192512 = CMC 1101873 = P 2784

EG Tau = 2MASSI J0545439+183815 = 2MASSI J0545439+183815 = P 2791

EI Tau = 2MASSI J0546565+175431 = CCS 160 = P 2793

GP Tau = HD 37291 (Mc) = BD +24°898 = 2MASSI J0538326+250006 = AAO +24°117 = AGK3 +24°524 = CSV 636 = DO 11425 (M6) = IRC +20116 = MSX5C G182.5147–03.4131 = P 2767 = RAFGL 788

GQ Tau = HD 246295 (B9) = 2MASSI J0541349+255952 = CMC 1101861 = CSV 655 = HV 6919 = P 2775. Type EA/SD:.

HY Tau = 2MASSI J0543223+192405 = CMC 1006123 = CSV 669 = P 2782

V591 Tau = 2MASSI J0447321+274107 = CSV 439 = DO 10751? = P 2642. The identification (Rastorguev, A.S. 1972, Perem. Zvezdy Prilozhenie, 1, 319) with DO 10751 (M7), nominally $5.'4$ distant, is extremely doubtful; however, no alternative candidate is evident in USNO-A2.0.

V592 Tau = 2MASSI J0501421+251543 = CSV 475 = P 2664. Type EA/DS.

V720 Tau = 2MASSI J0452016+290004 = CSV 445 = IRC +30099 = P 2647 = RAFGL 4383S

V721 Tau = 2MASSI J0456033+273559 = CMC 903767 = CSV 460 = P 2654

V723 Tau = 2MASSI J0506461+283523 = CSV 490 = P 2682. Type EA/SD.

V836 Tau = 1E 0500.0+2518 = 1RXS-F J050306.1+252343 = 1WGA J0503.0+2523 = 1WGA J0503.1+2523 = 2RXP J050306.0+252312 = 2RXP J050306.6+252320 = BCK99 L1544A-6 = CSV 479 = FK X-Ray 3 = FK83 LDN 1544-12 = HRC 429 = NSV 01811 = P 2669

V961 Tau = 2MASSI J0544259+215313 = CSV 674 = Case 580 = DO 11529 (K5) = MSX5C G185.8816–03.9013? = NSV 02602 = P 2786
NSV 01785 = 2MASSI J0458098+310846 = CSV 100424 = P 2658
NSV 01812 = 2MASSI J0503585+330134 = CSV 100436 = DO 10994 (M4) = P 2670
NSV 01813 = CSV 100437 = P 2672
NSV 01825 = 2MASSI J0506340+304601 = CSV 489 = P 2680
NSV 01829 = 2MASSI J0507002+265919 = CSV 492 = GSC 1853-01854 = P 2684
NSV 01845 = 2MASSI J0509074+260818 = CSV 502 = P 2693
NSV 01869 = 2MASSI J0512468+293859 = CSV 510 = P 2700. USNO-A1.0 and USNO-A2.0 counterparts are blends with a companion, fainter on GSS (Pal-QV) plate 00DH, at $\rho = 4\farcs07$, $\theta = 66\fdg7$. It is unclear which component is the suspected variable.
NSV 01885 = 2MASSI J0515076+182229 = 2MASSI J0515076+182229 = CSV 515 = P 2705
NSV 01886 = 2MASSI J0515290+224208 = CSV 518 = P 2706
NSV 01890 = 2MASSI J0515411+184037 = CSV 520 = P 2709
NSV 01894 = 2MASSI J0516010+251805 = CSV 521 = P 2708
NSV 01896 = 2MASSI J0516092+312603 = CSV 519 = P 2707
NSV 01900 = 2MASSI J0516128+184058 = CSV 100466 = IRAS F05132+1837 = P 2711
NSV 01914 = 2MASSI J0518401+324204 = CSV 100469 = MSX5C G173.6853–02.7852 = P 2715
NSV 01916 = 2MASSI J0518552+293821 = CSV 100470 = P 2716
NSV 01919 = BD +24°815 = 2MASSI J0519019+244549 = AGK3 +24°483 = CSV 532 = HV 6899 = IRAS 05159+2442 = IRC +20104 = P 2717. The identifications of BD +24°815 in the *AGK3* (AGK3 +24°482) and *PPM* (PPM 94259) catalogues are incorrect.
NSV 01924 = 2MASSI J0519566+275941 = CSV 100476 = P 2719
NSV 01930 = 1RXS-F J052022.1+294420 = 2MASSI J0520211+294424 = CSV 537 = P 2721
NSV 01931 = 2MASSI J0520062+172847 = CSV 541 = P 2728
NSV 01932 = 2MASSI J0520096+192848 = CSV 540 = P 2727
NSV 01933 = 2MASSI J0520264+280416 = CSV 100478 = P 2724
NSV 01935 = 2MASSI J0520354+285848 = CSV 539 = P 2725
NSV 01942 = 2MASSI J0521514+283842 = CSV 548 = P 2731
NSV 01949 = 2MASSI J0522457+290704 = CSV 552 = P 2734
NSV 01954 = 2MASSI J0524139+322744 = CSV 100480 = P 2736
NSV 01958 = CSV 559 = P 2738
NSV 01961 = 2MASSI J0525018+330834 = CSV 100481 = P 2737. Both GSC images classified non-stellar. There is a companion, fainter on GSS (Pal-QV) plate 00DH, at approximately $\rho = 5\farcs0$, $\theta = 96°$.
NSV 01968 = 2MASSI J0525205+294536 = CSV 561 = P 2739. Absent from USNO-A1.0 and USNO-A2.0.
NSV 01973 = 2MASSI J0525431+203759 = CSV 565 = P 2741
NSV 01976 = CSV 567 = P 2744
NSV 01979 = CSV 100484 = P 2743
NSV 01981 = CSV 569 = P 2745
NSV 01987 = 2MASSI J0527064+165611 = CSV 571 = P 2746
NSV 01995 = CSV 100488 = P 2748
NSV 02026 = 1RXS-F J052954.9+184817 = CSV 580 = P 2750
NSV 02059 = CSV 582 = P 2751
NSV 02118 = 2MASSI J0533291+242701 = CSV 591 = P 2754
NSV 02134 = 2MASSI J0533352+182056 = CSV 592 = P 2755
NSV 02181 = 2MASSI J0534411+175318 = CSV 595 = P 2758
NSV 02249 = 2MASSI J0535338+235318 = CSV 602 = P 2759
NSV 02302 = 2MASSI J0535552+251827 = CSV 604 = P 2760. GSC image classified non-stellar.
NSV 02365 = 2MASSI J0536076+175149 = 2MASSI J0536075+175150 = CSV 100580 = P 2761
NSV 02419 = 2MASSI J0536541+233408 = CSV 100613 = P 2762
NSV 02442 = 2MASSI J0537266+222031 = CSV 629 = P 2765
NSV 02520 = 2MASSI J0539348+185238 = CSV 648 = P 2773
NSV 02542 = 2MASSI J0540269+175238 = CSV 100667 = P 2774
NSV 02662 = 2MASSI J0550406+224146 = CSV 100687 = P 2794
HV 6878 = 2MASSI J0507358+290016 = CSV 494 = P 2686. HV 6878 is marked as comparison star ‘a’ on Tsesevich’s chart for CSV 494.
Ts 492 = 2MASSI J0507009+265637. Both GSC images are classified non-stellar. There is a companion, fainter on GSS (Pal-QV) plate 005N, at $\rho = 6\farcs29$, $\theta = 6\fdg2$.

Table 5: Positions and identifications in MWF 239

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
V501 Cen	7375	7816-00194	14 11 49.978	–43 56 30.70		RR	15
V503 Cen	7376		14 12 45.278	–40 23 46.97		RRAB	1 11 15
V505 Cen	7377		14 13 01.246	–45 33 10.22	14098–4519	M	2 11 15
V633 Cen	7378	7816-01657	14 13 02.568	–43 48 18.25		RR	
V506 Cen	7379		14 13 14.818	–41 02 37.76		M	11 15
V415 Cen	7380	7816-02232	14 13 19.774	–44 53 38.22		CWA	2 11 15
V507 Cen	7381	8264-01357*	14 14 37.746:	–45 48 43.86:	14114–4534	SRA	2 11 15
V508 Cen	7382	7812-02854	14 14 56.750	–41 35 54.71		EW*	1 11 15
V637 Cen	7383	7808-01155	14 16 34.891	–40 00 26.78		EW*	1 11 15
V510 Cen	7384	7808-00774	14 17 01.054	–40 40 16.00	14139–4026	L	1 11 15
V511 Cen	7385	7804-00675	14 17 23.982	–37 42 41.79	14143–3728	M	11 15
V512 Cen	7386	7804-01376	14 19 29.995	–38 42 45.61		E	15
CU Lup	7387		14 19 49.322	–46 08 39.12	F14165–4554	M	11 15
CV Lup	7388	7817-01930	14 20 09.962	–44 34 02.24		RRAB	11 15
V514 Cen	7389		14 20 02.071	–40 28 07.04		RRAB	11 15
CW Lup	7390	7817-00118	14 20 23.078	–44 31 59.76		RR	10 11 14 15
CX Lup	7391	8277-02618	14 21 16.438	–46 06 59.33		E/SD	2 11 15
CY Lup	7392	7817-01982	14 22 02.362	–44 17 46.61	14188–4404	SRB	11 15
V515 Cen	7393		14 22 01.881	–42 05 13.99		RRAB	11 15
NSV 06639	7394	8277-02176*	14 22 20.310	–45 22 05.50			
EY Lup	7395		14 23 05.541	–42 44 52.26		RR	11 15
CZ Lup	7396		14 23 15.370	–44 37 22.30	14200–4423	M:	11 15
DD Lup	7397	7813-00593	14 23 20.729	–42 39 39.78	14202–4226	M	11.15
DE Lup	7398	7817-00530	14 23 53.486	–44 50 11.72		M	15
V516 Cen	7399	7809-02011	14 23 51.720	–40 21 25.42	14207–4008?	SR	15
DF Lup	7400	7817-01454	14 24 26.280	–44 14 40.09	14212–4401	M	11 15
V517 Cen	7401	7809-00116	14 25 31.872	–40 53 33.72	F14223–4039	L	11 15
DG Lup	7402	7817-00444	14 25 44.153	–44 18 34.09		EW*	11 15
DH Lup	7403		14 26 07.769	–43 50 48.32		RRAB	11 15
V518 Cen	7404	7813-03003*	14 27 17.104	–41 47 03.70		RR	11 15
EZ Lup	7405		14 28 10.951	–44 45 27.26		RR	11 15
V519 Cen	7406		14 28 29.509	–41 41 55.80	F14253–4128?	M	11 15
DI Lup	7407		14 29 33.254	–45 44 37.72		RRAB	
V895 Cen	7408		14 29 27.229	–38 04 09.99		E*	6 7
V522 Cen	7409	7307-01643	14 29 27.578	–37 13 44.42		RR	11 14 15
V523 Cen	7410		14 29 42.279	–40 23 23.75		RR	15
V640 Cen	7411	7307-02446	14 29 42.109	–37 11 56.04		RR	11 15
V524 Cen	7412	7809-00603	14 29 56.340	–39 22 30.72	14268–3909	LB	3 4 11 15
V525 Cen	7413	7814-00271	14 30 20.304	–42 00 33.84		LB	11 15
NSV 06689	7414		14 31 01.638	–37 47 51.84		S	
V526 Cen	7415		14 31 37.183	–41 48 44.72		RRAB	11 15
DK Lup	7416		14 32 24.804	–44 46 29.71		RRAB	11 15
V527 Cen	7417		14 32 18.325	–40 49 13.97		RR	11 15
V528 Cen	7418	7307-01827	14 32 12.836	–37 18 05.67		L	11 15
V529 Cen	7419		14 32 18.948	–38 08 35.81		RRAB	11 15
V530 Cen	7420		14 32 57.084	–40 54 34.64		M:	3 4 15
DL Lup	7421	8278-00844	14 33 15.523	–46 12 42.08	14299–4559	LB	11 15
DN Lup	7422		14 33 23.835	–43 20 45.73		RR	11 15
DO Lup	7423	7818-00075	14 33 51.632	–43 19 30.60	14306–4306	LB	11 15
DP Lup	7424	8278-01101*	14 34 25.421:	–45 30 54.76:		SR	11 15
V531 Cen	7425	7810-00164	14 35 08.482	–40 14 30.39	14320–4001	LB	3 4 11 25
DQ Lup	7426	7818-00033	14 35 21.479	–43 09 52.03		RR	11 15
DR Lup	7427	7814-02038	14 35 20.328	–42 55 40.91		SR	15
DS Lup	7428		14 35 34.720	–44 06 49.80		RRAB	11 15
DU Lup	7429		14 36 37.910	–43 15 40.30		RRAB	15
V532 Cen	7430	7810-00111	14 36 45.034	–41 12 33.64	14335–4059	RS:	3 4 5 11 12 13 15
DV Lup	7431	7814-02364	14 36 48.005	–42 38 43.84		RRAB	11 15
V533 Cen	7432	7810-00197	14 36 42.862	–39 27 56.56	14335–3914	SR	3 4 11 15
V534 Cen	7433	7810-02299	14 37 33.662	–39 30 06.19		RR	3 4 11 15

Table 5: Positions and identifications in MWF 239

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
V535 Cen	7434	7308-01701	14 37 27.342	–37 03 01.35		RR	11 14 15
V536 Cen	7435	7806-00150	14 37 50.900	–37 34 33.88		E/SD:	11 15
V537 Cen	7436	7810-00170	14 38 10.704	–39 56 30.88	14350–3943	LB	3 4 11 15
V538 Cen	7437	7810-01133*	14 38 13.868	–40 25 37.94		RR	3 4 14 15
V539 Cen	7438	7814-00865	14 38 20.944	–41 46 03.36		RR	11 15
V540 Cen	7439		14 38 36.719	–40 18 21.22		ISA	11 15
DX Lup	7440	8279-01910	14 39 11.782	–45 15 42.70		M:	11 15
DY Lup†	7441		14 39 57.204	–43 14 09.49	14367–4301	M	11* 15*
DZ Lup†	7442	7818-00118	14 39 46.139	–43 15 47.16	14365–4302	LB:	11* 15*
EE Lup	7443		14 40 08.236	–45 32 45.65	14368–4519	M	11 15
V542 Cen	7444		14 40 14.352	–40 29 53.47		RR	3 4 11 15
EF Lup	7445	7831-02335	14 40 49.207	–44 41 56.26		LB	11 15
NSV 06758	7446		14 40 45.678	–41 45 52.57			
V543 Cen	7447	7827-02002	14 41 05.508	–42 24 52.96		SR	11 15
EG Lup	7448	8279-02064	14 42 28.968	–45 14 50.96		RRAB	11 15
V544 Cen	7449		14 42 21.129	–38 40 24.15		E/SD:	11 15
V546 Cen	7450	7823-02081*	14 43 10.393	–40 48 20.30	14400–4035	L	15
V547 Cen	7451	7819-00168	14 43 10.570	–38 12 10.76		RRAB	11 15
V642 Cen	7452		14 43 27.243	–41 02 06.08	14402–4049	RR	11 15
V548 Cen	7453	7823-00185	14 43 48.866	–40 17 45.92	14406–4005	L	11 15
EH Lup	7454	7831-01437	14 44 50.167	–43 58 15.85		RRAB	11 15
V551 Cen	7455		14 45 48.950	–41 26 12.85	14426–4113	SR	15
V552 Cen	7456		14 46 30.677	–41 53 35.51		RR	11 15
NSV 06795	7457	7827-00990*	14 46 58.216	–41 17 53.37			
EI Lup	7458	7831-02097*	14 47 24.980	–44 39 13.73		RRAB	11 15
V554 Cen	7459		14 47 34.541	–37 18 16.54		RRAB	11 15
V555 Cen	7460	7827-01238	14 48 05.402	–41 45 23.65		SR	11 15
V556 Cen	7461	7827-00860*	14 48 10.517	–41 34 44.25	14449–4122	SR	11 15
NSV 06804	7462	7827-00687*	14 48 21.286	–42 15 43.71	F14451–4203		
V557 Cen	7463		14 48 14.421	–38 18 32.44	14451–3806	M	11 15
EL Lup	7464	7831-01029	14 48 34.150	–43 58 26.26		SR	
V558 Cen	7465	7827-00010	14 49 00.648	–41 26 56.80		RR	11 15
V559 Cen	7466	7827-01170	14 49 23.201	–41 50 38.44		RRAB	11 15
EM Lup	7467		14 49 31.420	–43 24 35.50	F14462–4312	M	11 15
V560 Cen	7468	7823-01454	14 49 24.847	–40 04 28.92		L	11 15
V561 Cen	7469	7823-01426	14 49 28.915	–40 05 07.48	14462–3952	L	11 15
RY Cen	7470	7827-00067	14 49 52.435	–42 30 49.04	14466–4218	M	13
V563 Cen	7471		14 49 50.867	–38 53 08.89		RRAB	15
V564 Cen	7472		14 50 14.650	–37 39 31.97		RR	15
V565 Cen	7473	7824-01194*	14 51 14.539	–40 58 34.22		EW*	15
EN Lup	7474	7832-01338	14 51 51.110	–44 59 06.32		SR	11 15
EO Lup	7475		14 51 57.754	–42 41 20.47		M	15
EP Lup	7476	7832-00993	14 52 33.451	–43 24 29.63	14492–4312	M	11 15
NSV 06837	7477		14 52 37.709	–37 43 57.71			
ER Lup	7478	7832-00225	14 54 54.070	–43 14 01.25	F14516–4301	SR	15
ES Lup	7479	7828-01712	14 55 56.050	–42 34 55.99	14526–4222	M	11 15
ET Lup	7480	7828-00114	14 56 34.991	–42 40 02.80	14533–4227	LB	11 15
EU Lup	7481	7832-00391*	14 57 29.108	–43 24 51.66		RRAB	11 15
			Variables previously announced by Luyten				
V500 Cen	7482	7807-00031	14 09 14.578	–40 15 03.46	14061–4000	M	1 13
V502 Cen	7483	7808-02161	14 12 09.278	–40 10 26.08	F14090–3956	M	1 11 13 15
CT Lup	7484		14 19 40.640	–44 29 33.32	14165–4415?	M	11 15
V520 Cen	7485		14 28 42.225	–39 19 55.83	14256–3906	M	3 4 11 15
V521 Cen	7486	7813-02759	14 28 45.046	–41 52 28.24		M	11 15
DM Lup	7487	7818-01191	14 33 23.611	–44 59 50.03	14301–4446	M	11 15
DW Lup	7488		14 37 30.086	–44 22 11.74	14342–4409	M	
V541 Cen	7489	7806-00806	14 39 26.268	–37 40 54.55		M:	15
V545 Cen	7490		14 42 55.256	–41 18 47.68	14397–4106	M	11 15

Table 5: Positions and identifications in MWF 239

GCVS	HV	GSC	RA(J2000)	Dec(J2000)	IRAS	Type	Charts
V549 Cen	7491		14 43 52.759	–39 54 41.97	14407–3942	M	11 15
V562 Cen	7492	7827-00935	14 49 57.175	–41 55 58.19	14466–4143	M	11 15
EQ Lup	7493		14 54 40.860	–43 44 23.84	F14513–4332	M	11 15
V566 Cen	7494		14 54 44.668	–38 56 46.80	14515–3844	M	11 15
V567 Cen	7495		14 55 57.214	–38 58 28.90		M:	11 15
V568 Cen	7496		14 56 09.863	–41 39 04.97	14529–4126	M	11 15
V569 Cen	7497	7828-01539	14 57 52.874	–41 47 08.04	F14546–4135	M	11 15
			Known variables (Prager 1935, *et al.*)				
V504 Cen	8574	7808-01570	14 12 49.128	–40 21 37.42		RCB	1 11 13 15 16
V509 Cen	8578	7812-01137	14 16 10.150	–42 19 50.27		RR	11 15
V513 Cen	8582	7804-02301	14 19 31.229	–38 51 29.05		RRAB	11 15
RW Lup	3580	7817-02244	14 26 21.314	–44 09 11.95	14231–4355	M	8 9 10 13 15
Z Lup	3164	7818-00129	14 35 51.744	–43 22 02.93	14326–4309	LB	9 10 13 15
V550 Cen	8618	7309-02681	14 44 58.654	–37 21 47.84		M	11 15
TY Lup	4669	8279-00273	14 47 17.326	–45 10 18.37	14439–4457	M	11 15
EK Lup	8623	8279-00119*	14 47 17.920	–45 28 33.63	14439–4516	LB	11 15
NSV 06866	8639	7310-00875	14 58 03.518	–35 49 04.94			
WZ Lup	4685		15 00 12.165	–45 22 52.22		M	11 15
NSV 06880	8641		15 01 09.779	–42 44 51.56	14579–4233		
AO Cen	3537	7829-00911	15 00 51.629	–42 29 36.65	14575–4217	M	
YY Lup	4689	8293-02228	15 02 57.761	–45 28 04.19		E/SD:	11 15

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REMARKS to Table 5:

RY Cen = HD 130471 (Md) = 135.1904 = HV 868 = IRAS F14466–4218 = P 3826
AO Cen = CoD $-41°9373$ = CPD $-41°6993$ = IRAS F14575–4217
V415 Cen = P 3686
V500 Cen = CoD $-39°8730$ = 230.1933 = IRAS F14062–4000? = P 933
V501 Cen = P 3680
V502 Cen = 233.1933 = P 936
V503 Cen = P 3681
V504 Cen = 354.1935 = P 3683
V505 Cen = P 3682. There is a companion, fainter on GSS (SERC-J) plate 02MC, at $\rho = 12\farcs20$, $\theta = 21\fdg7$, which cannot be excluded as the variable.
V506 Cen = P 3685

V507 Cen = IRAS F14114–4534? = P 3690 Absent from USNO-A2.0. The GSC images (both classified non-stellar) and USNO-A1.0 counterpart are blends with a companion, brighter on DSS2 (UK Schmidt IIIaF) plate A0UP, at $\rho = 5''\!.48$, $\theta = 203^\circ\!.1$.
V508 Cen = P 3691. Type EW/KW.
V509 Cen = 356.1935 = P 3692. The GSC images (both classified non-stellar) and USNO-A1.0 and USNO-A2.0 counterparts are probably affected by a companion, fainter on GSS (SERC-J) plate 0163, at $\rho = 4''\!.24$, $\theta = 294^\circ\!.9$.
V510 Cen = IRAS F14139–4026 = P 3694
V511 Cen = P 3695
V512 Cen = P 3704
V513 Cen = 235.1933 = P 941
V514 Cen = P 3707
V515 Cen = P 3712
V516 Cen = P 3719
V517 Cen = P 3723
V518 Cen = P 3727. GSC image is classified non-stellar. There is a companion, fainter on GSS (SERC-J) plate 0163, at $\rho = 5''\!.43$, $\theta = 96^\circ\!.9$.
V519 Cen = P 3730
V520 Cen = 363.1935 = P 3732
V521 Cen = 364.1935 = P 3731
V522 Cen = P 3735
V523 Cen = P 3736
V524 Cen = CoD $-38^\circ 9415$ = IRAS F14268–3909? = P 3738 = PPM 745984
V525 Cen = P 3739
V526 Cen = P 3742
V527 Cen = P 3745
V528 Cen = IRAS F14291–3704? = P 3746
V529 Cen = P 3747
V530 Cen = P 3748
V531 Cen = P 3754
V532 Cen = 3A 1431–409 = AT 1431–409 = IRAS F14335–4059 = P 3762
V533 Cen = IRAS F14335–3914? = P 3764
V534 Cen = P 3767
V535 Cen = P 3768
V536 Cen = P 3770
V537 Cen = IRAS F14350–3943 = P 3771
V538 Cen = P 3772. GSC image is classified non-stellar. There is a companion, fainter on GSS (SERC-J) plate 04H2, at $\rho = 6''\!.82$, $\theta = 301^\circ\!.5$.
V539 Cen = P 3773. There is a companion, of equal brightness on GSS (SERC-J) plate 04H2, at $\rho = 10''\!.93$, $\theta = 172^\circ\!.5$, which cannot be completely exluded as the variable.
V540 Cen = P 3775
V541 Cen = 368.1935 = P 3782
V542 Cen = P 3787
V543 Cen = P 3791
V544 Cen = P 3796
V545 Cen = 373.1935 = IRAS F14397–4106 = P 3798
V546 Cen = IRAS F14399–4035 = P 3799. GSC image is classified non-stellar. There is a companion, fainter on GSS (SERC-J) plate 04H2, at $\rho = 8''\!.82$, $\theta = 186^\circ\!.1$.
V547 Cen = P 3800. There is a companion, fainter on GSS (SERC-J) plate 04H2, at approximately $\rho = 3''\!.7$, $\theta = 173^\circ$. It is unclear which component is the variable.
V548 Cen = CoD $-39^\circ 9155$ = IRAS F14406–4005 = P 3803
V549 Cen = 242.1933 = P 968. The USNO-A1.0 and USNO-A2.0 counterparts are blends with a companion, slightly fainter on GSS (SERC-J) plate 04H2, at $\rho = 6''\!.62$, $\theta = 127^\circ\!.2$. The component listed in Table 5 appears to be the variable.
V550 Cen = 243.1933 = P 970
V551 Cen = IRAS F14426–4113 = P 3806
V552 Cen = P 3807
V554 Cen = P 3813
V555 Cen = P 3815
V556 Cen = 1RXS-F J144806.2-413337? = P 3816. GSC image is classified non-stellar. There is a companion, fainter on GSS (SERC-J) plate 04H2, at $\rho = 5''\!.00$, $\theta = 156^\circ\!.6$.
V557 Cen = IRAS F14451–3806 = P 3819. Bright on DSS2 (UK Schmidt IIIaF) plate A2I7.
V558 Cen = P 3821

V559 Cen = P 3822
V560 Cen = P 3824
V561 Cen = IRAS F14462–3952 = P 3825
V562 Cen = 376.1935 = IRAS F14467–4143 = P 3827
V563 Cen = P 3828
V564 Cen = P 3830
V565 Cen = P 3832. Type EW/KW. GSC image is classified as non-stellar. There is a companion, fainter on GSS (SERC-J) plate 04H2, at $\rho = 5''.14$, $\theta = 357^\circ.1$.
V566 Cen = 244.1933 = IRAS F14515–3844? = P 977
V567 Cen = 245.1933 = P 979
V568 Cen = 382.1935 = IRAS F14529–4126 = P 3846
V569 Cen = 384.1935 = P 3851
V633 Cen = P 3684
V637 Cen = P 3693. Type EW/KW:.
V640 Cen = P 3737
V642 Cen = P 3801. IRAS 14402–4049 may correspond instead with HD 129364, $75''.5$ to the northwest.
V895 Cen = 2EUVE J1429–38.0 = Cen2 = CSV 2143 = EUVE J1429–38.0 = NSV 06680 = P 3734. Type E+AM:.
Z Lup = HD 128033 (Na) = CoD -42°9465 = 149.1908 = CCS 2173 = HIP 71386 = PPM 760481
RW Lup = HD 126387 (Mb) = CoD -43°9051 = CPD -43°6550 = HIP 70590 = IRAS F14231–4355?
TY Lup = IRAS F14439–4457?
CT Lup = 357.1935 = IRAS F14165–4415 = P 3701
CU Lup = P 3703. There is a companion, fainter on GSS (SERC-J) plate 011M, at $\rho = 2''.57$, $\theta = 171^\circ.4$. It is unclear which component is the variable.
CV Lup = P 3706
CW Lup = P 3708. The identification in the *Hipparcos Input Catalogue* (HIC 70079) is incorrect.
CX Lup = P 3709
CY Lup = IRAS F14188–4404 = P 3710
CZ Lup = IRAS F14200–4423 = P 3716
DD Lup = IRAS F14201–4225 = P 3717. Bright on GSS (SERC-J) plate 011M. There is a companion, slightly brighter on GSS (SERC-J) plate 0163, at $\rho = 3''.01$, $\theta = 278^\circ.6$.
DE Lup = P 3718
DF Lup = IRAS F14212–4401? = P 3720
DG Lup = P 3724. Type EW/KW.
DH Lup = P 3726
DI Lup = P 3733
DK Lup = P 3744
DL Lup = IRAS F14299–4559 = P 3749
DM Lup = 365.1935 = IRAS F14301–4446 = P 3750
DN Lup = P 3751
DO Lup = IRAS F14306–4306? = P 3752
DP Lup = P 3753. The GSC image (classified non-stellar) and USNO-A1.0 and USNO-A2.0 counterparts are blends with a companion, slightly brighter on GSS (SERC-J) plate 011M, at approximately $\rho = 5''.1$, $\theta = 199^\circ$. The component listed in Table 5 appears to be variable.
DQ Lup = P 3755
DR Lup = P 3756
DS Lup = P 3757
DU Lup = P 3761
DV Lup = P 3763
DW Lup = 366.1935 = IRAS F14342–4409? = P 3765
DX Lup = P 3777
DY Lup = IRAS F14367–4301 = P 3781. On the charts in Kazanasmas and in Tsesevich & Kazanasmas, the identifications of DY and DZ Lup are interchanged. In both cases, star '2' refers to DY Lup.
DZ Lup = IRAS F14365–4302 = P 3783 On the charts in Kazanasmas and in Tsesevich & Kazanasmas, the identifications of DY and DZ Lup are interchanged. In both cases, star '1' refers to DZ Lup.
EE Lup = IRAS F14368–4519 = P 3785
EF Lup = P 3789
EG Lup = P 3794
EH Lup = P 3804
EI Lup = P 3811. GSC image is classified non-stellar. There are companions, both fainter on GSS (SERC-J) plate 011N, at approximately $\rho = 5''.0$, $\theta = 347^\circ$, and $\rho = 5''.5$, $\theta = 123^\circ$.
EK Lup = 375.1935 = IRAS F14439–4516? = P 3812 GSC image is classified non-stellar. There is a companion, fainter on GSS (SERC-J) plate 011N, at $\rho = 7''.99$, $\theta = 238^\circ.0$.

EL Lup = P 3820
EM Lup = P 3823
EN Lup = P 3834
EO Lup = P 3835
EP Lup = IRAS F14492–4312? = P 3837
EQ Lup = 381.1935 = IRAS F14513–4332 = P 3843. There is a companion, brighter on GSS (SERC-J) plate 011N, at $\rho = 9''.42$, $\theta = 170^\circ.1$.
ER Lup = 1RXS J145450.4-431231? = P 3844
ES Lup = IRAS F14526–4222 = P 3845
ET Lup = CoD $-42^\circ 9820$ = P 3848 = PPM 760744
EU Lup = P 3849. GSC image is classified non-stellar. There is a close companion, fainter on GSS (SERC-J) plate 011N, at $\rho = 7''.02$, $\theta = 95^\circ.4$.
EY Lup = P 3715
EZ Lup = P 3729
NSV 06639 = CSV 2129 = P 3713. Absent from both USNO-A1.0 and USNO-A2.0. GSC image is classified non-stellar. There is a companion, fainter on GSS (SERC-J) plate 011M, at $\rho = 7''.87$, $\theta = 39^\circ.5$.
NSV 06689 = CSV 2146 = P 3741
NSV 06758 = CSV 2175 = P 3790
NSV 06795 = CSV 2189 = P 3809. GSC image is classified non-stellar. The USNO-A1.0 and USNO-A2.0 counterparts are blends with companions, one roughly equal in brightness on GSS (SERC-J) plate 04H2 at $\rho = 6''.84$, $\theta = 69^\circ.7$, and a second, fainter on the same GSS plate, at approximately $\rho = 8''.7$, $\theta = 95^\circ$.
NSV 06804 = CSV 2197 = P 3817. Both GSC images are classified non-stellar. There is a companion, fainter on GSS (SERC-J) plate 04H2, at $\rho = 6''.37$, $\theta = 249^\circ.4$.
NSV 06837 = CSV 2208 = P 3840
NSV 06866 = 246.1933 = CSV 2222 = P 980. There is a companion, slightly fainter on GSS (SERC-J) plate 00AP, at $\rho = 12''.51$, $\theta = 288^\circ.5$.
NSV 06880 = 385.1935 = CSV 2230 = IRAS F14578–4233? = P 3853. The USNO-A1.0 and USNO-A2.0 counterparts are blends with a companion, slightly brighter on GSS (SERC-J) plate 011N, at $\rho = 5''.30$, $\theta = 10^\circ.5$.

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GSC 00279-00321: A NEW W UMa ECLIPSING BINARY

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Name of the object:
GSC 00279-00321

Equatorial coordinates:	**Equinox:**
R.A.= $11^h57^m51\overset{s}{.}278$ **DEC.**= $06°27'04\overset{''}{.}70$	2000

Observatory and telescope:
M. Koppelman: Private observatory, MN USA, 160-mm Newtonian astrograph; D. Terrell: Sommers Bausch Observatory, CO USA, 60-cm Boller and Chivens telescope; T. Droege: Private Observatory TOM1, Batavia, IL, dual 100-mm refractors

Detector:	M. Koppelman: SBIG ST-237A; D. Terrell: SBIG ST-8; T. Droege: Custom built dual CCD 442A

Filter(s):	M. Koppelman: None; D. Terrell: Johnson V; T. Droege: Johnson V and Cousins I, Bessel formulation

Date(s) of the observation(s):
2002.02.07, 2002.05.31, 2002.06.01, 2002.06.06

Comparison star(s):	GSC 00279-00536 GSC 00279-00287

Transformed to a standard system:	No

Availability of the data:
Through IBVS Web-site as file 5299-t1.txt

Type of variability:	EW

Remarks:

The variability of GSC 00279-00321 was clearly demonstrated by data acquired from the TASS survey (*viz.* Droege, 2002; Henden, 2001) in February of 2002. The period and nature of the variability was not immediately apparent. Figure 1 shows the TASS V-band discovery observations and follow-up V-band observations by Terrell.

Koppelman made extensive unfiltered observations to try to characterize the light curve. Figure 2 shows the characteristic shape of a W UMa binary. The system shows a large asymmetry of about 0.1 magnitudes between the maxima. The system may be associated with the X-ray source J115752.7+062658 as W UMa systems frequently show X-ray emission arising from coronal activity. Although our data are limited, there are indications that the system may exhibit light curve changes on time scales of weeks.

Using all of the available data, the period was determined by eye examination of phase plots at different trial values. Given the very limited temporal coverage of our observations, attempts to use more rigorous period-finding techniques were unsuccessful. A preliminary ephemeris for the brightness minimum is

$$2452425.7329 + 0^{\rm d}\!.2898 \times E \qquad (1)$$

Coordinates are from the Tycho catalog, adjusted for proper motion by VizieR.

Acknowledgements:

Many thanks are due to Tom Droege, Arne Henden, John Greaves and everyone else involved with The Amateur Sky Survey (TASS). This research made use of the SIMBAD database, operated by the CDS at Strasbourg, France.

References:

Droege, T., 2000, *The Amateur Sky Survey (TASS)*, `http://www.tass-survey.org/`

Henden, A. A., 2001, *"The TASS Mark IV Photometric Survey"*, *JAAVSO*, **29**, 118

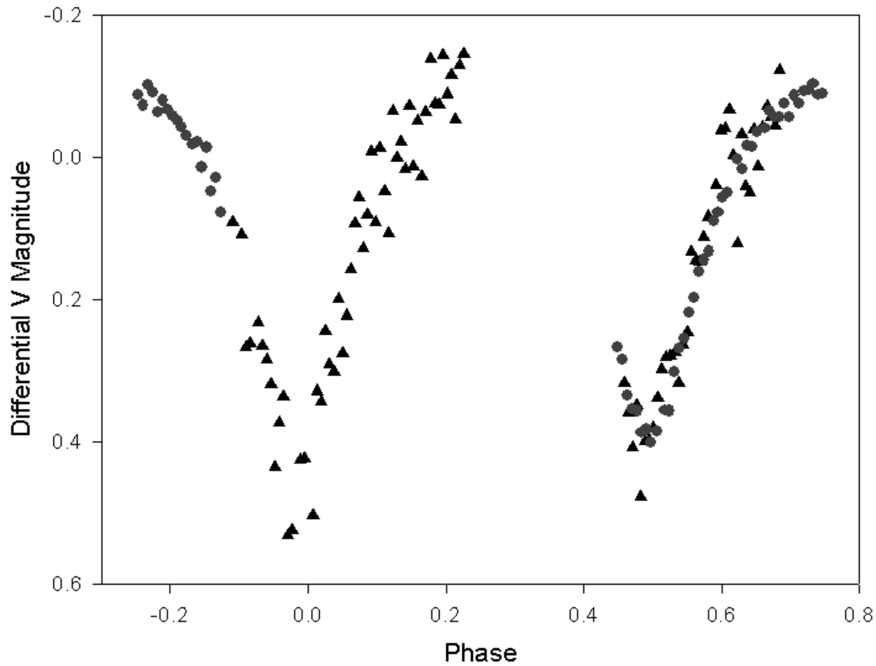

Figure 1. TASS discovery (triangles) and Terrell follow-up (circles) V-band observations.

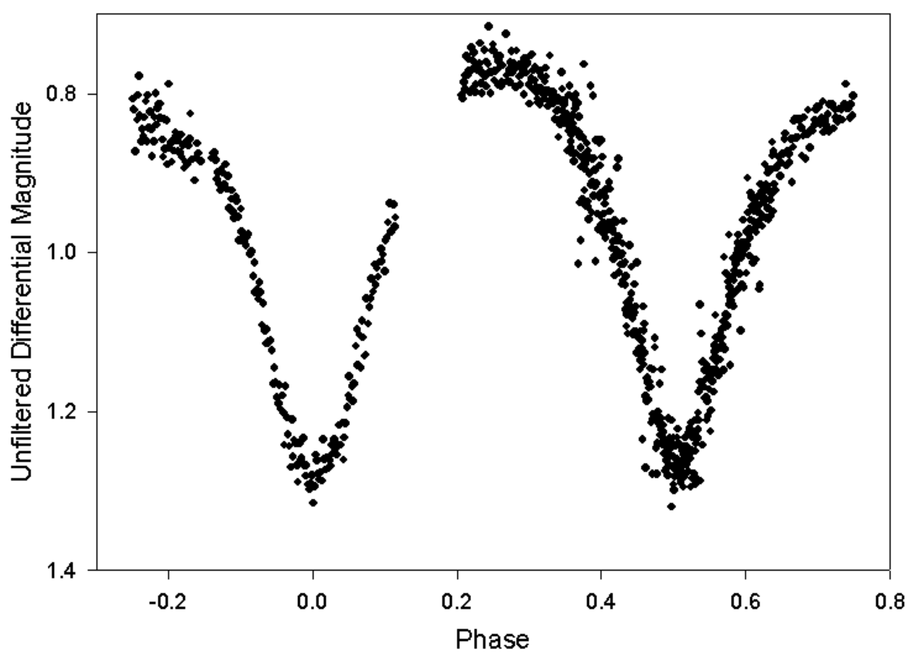

Figure 2. Koppelman unfiltered observations.

ERRATUM FOR IBVS 5278

The epoch that was given for the new classical Cepheid NSV 02852 is the time of maximum, so the ephemeris is:

$$HJDMax = 2452234.46 + 2.1371 \times E$$

The correct reference of Cannon & Pickering:

Cannon, A.J., and Pickering, E.C. 1918-1924, The Henry Draper Catalogue and Extension, Ann. Astron. Obs. Harvard College, 91-100

(Although HD252611 is in the Henry Draper Catalogue, it was actually published in the HD catalogue extension.)

Enrique Garcia-Melendo

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PHOTOELECTRIC MINIMA OF SOME ECLIPSING BINARY STARS

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Observatory and telescope:
40-cm Cassegrain telescope of the TÜBİTAK National Observatory and 30-cm Maksutov telescope of the Ankara University Observatory.

Detector:	OPTEC SSP-5A photometer containing a side-on R1414 Hamamatsu photomultiplier.

Method of data reduction:
Reduction of the observations were made in the usual way (Hardie 1962).

Method of minimum determination:
Times of minima were determined by the method of Kwee and van Woerden (1956).

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
WY Cnc	EA/SD/RS	09 01 55	+26 41 22	BD+27 1708	26352.3895	0.8293712	1
BO CVn	EW	13 59 08	+40 49 09	BD+41 2450	46895.4483	0.5174617	2
CG Cyg	EA/SD/RS	20 58 13	+35 10 29	BD+34 4216	22967.4184	0.6311435	3
AK Her	EW/KW	17 13 57	+16 21 00	BD+16 3123	22977.2540	0.4215221	4
SW Lac	EW/KW	22 53 41	+37 56 18	BD+37 4715	51056.2896	0.3207151	5
GR Vir	EW/KW	14 45 20	−06 44 04	BD−06 4066	45665.6415	0.3469788	6
NN Vir	EB	14 19 37	+05 53 46	BD+06 2864	50595.3452	0.4806900	7

Source(s) of the ephemeris:
1.: Hall & Kreiner (1980); 2.: Albayrak et al. (2001); 3.: Sowell et al. (2001); 4.: Woodward (1942); 5.: Pribulla et al. (2001); 6.: Cereda et al. (1988); 7.: Rucinski & Lu (1999)

†TÜBİTAK : The Scientific and Technical Research Council of Turkey

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
WY Cnc	52308.3696	0.0002	I	BV	−0.0210	Şn-Ak
BO CVn	52070.3231	0.0002	II	UBV	−0.0010	Hs-Km
	52375.3677	0.0002	I	UBV	0.0000	Al-Tn
CG Cyg	52196.3029	0.0002	I	UBV	−0.0021	Al-Çt
AK Her	52112.4686	0.0003	I	UBV	0.0306	Hs-Çğ
	52126.3805	0.0003	I	UBV	0.0323	Hs-Çğ
SW Lac	52188.4083	0.0001	I	BV	−0.0056	Tn-Yl
	52195.3055	0.0002	II	BV	−0.0038	Tn-Yr
	52195.4641	0.0001	I	BV	−0.0056	Tn-Yr
	52450.4316	0.0004	I	BV	−0.0066	Bl-Tn
GR Vir	52375.5126	0.0001	I	BVR	−0.0050	Al-Tn
	52399.4499	0.0003	I	UBV	−0.0091	Çt-El
	52440.3970	0.0002	I	BV	−0.0055	Tn-Bl
	52443.3443	0.0003	II	BV	−0.0076	Tn-Bl
	52460.3464	0.0002	II	BVR	−0.0075	Tn-Şn
	52464.3366	0.0003	I	BVR	−0.0075	Tn-Şn
NN Vir	52405.3689	0.0002	II	BV	−0.0145	Tn-Sz
	52424.3554	0.0005	I	BV	−0.0153	Tn-Bl
	52450.3149	0.0003	I	BV	−0.0130	Tn-Bl
	52461.3667	0.0001	I	BV	−0.0171	Sz-Kr
	52462.3300	0.0004	I	BV	−0.0151	Çt-Ak

Explanation of the remarks in the table:

Ak: O. Aksu, Al: B. Albayrak, Bl: İlker Bulca, Çğ: A. Çağlar, Çt: C. Çetintaş, El: A. Elmaslı, Hs: E. Hastürk, Km: B. Kömürcü, Kr: T. Karakaş, Şn: H. V. Şenavcı, Sz: A. S. Sezgin, Tn: T. Tanrıverdi, Yl: F. Yıldız, Yr: E. D. Yörük

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