COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 4953

Konkoly Observatory
Budapest
6 September 2000

HU ISSN 0374 – 0676

UBV OBSERVATIONS OF AG Dra IN THE END OF THE LATEST ACTIVE PHASE AND AFTER IT

TOMOV, N.; TOMOVA, M.

NAO Rozhen, Institute of Astronomy, P.O. Box 136, BG-4700 Smolyan, Bulgaria,
e-mail: rozhen@mbox.digsys.bg

The photometric history of the symbiotic star AG Dra includes many active phases separated by quiescent periods, which are characterized with an U colour orbital variability whose amplitude is about one magnitude. This variability is supposed to be due to an occultation of a bright nebular region by the cool giant in the system (Mikolajewska et al. 1995, Friedjung et al. 1998). The last active phase was characterized by five rapid brightenings realized every year from 1994 to 1998 (Petrik & Hric 1994, Skopal & Chochol 1994, Montagni et al. 1996, Petrik et al. 1998, Tomova & Tomov 1998). Their amplitudes were about one magnitude in the V band and reached up to four magnitudes in the U band. In this note we present new UBV photometric data acquired during the latest eruption in 1998 and after it, when the brightness gradually reached its quiescent values.

Table 1: Photometric observations of AG Dra

JD − 2450000	n	V	B	U	JD − 2450000	n	V	B	U
828.7	2	9.790	11.176	11.566	1357.3	3	9.728	11.097	11.525
865.7	3	9.707	11.103	11.429	1401.3	3	9.702	11.094	11.460
866.6	3	9.713	11.089	11.433	1404.3	3	9.708	11.061	11.442
867.6	4	9.728	11.098	11.418	1408.3	2	9.715	11.101	11.469
877.6	3	9.725	11.089	11.402	1437.3	3	9.766	11.150	11.422
1007.5	2	9.659	10.828	10.195	1509.2	1	9.713	11.097	11.338
1015.4	3	9.621	10.680	10.023	1510.2	1	9.702	11.087	11.324
1027.3	2	9.410	10.334	9.389	1581.6	3	9.758	11.120	11.112
1087.2	2	9.643	10.764	10.181	1626.5	4	9.753	11.088	11.026
1088.2	2	9.628	10.777	10.222	1627.5	4	9.740	11.090	11.011
1226.6	3	9.747	11.148	11.402	1715.4	3	9.822	11.222	11.320
1239.6	3	9.754	11.135	11.407	1716.5	2	9.833	11.235	11.343
1293.4	3	9.818	11.219	11.513	1718.5	2	9.823	11.220	11.362
1298.4	4	9.797	11.217	11.518	1721.4	3	9.827	11.240	11.379
1332.4	3	9.794	11.190	11.527					

Three colour UBV photometry of AG Dra was obtained during January 1998–June 2000 (Table 1) with a single channel photoelectric photometer, mounted at the Cassegrain

focus of the 0.6-m telescope of the National Astronomical Observatory Rozhen. The comparison stars and the accuracy of the measurements were the same like those presented in the work of Tomova & Tomov (1998). To consider our quiescent data we used the ephemeris JD($U_{\rm min}$) = 2 442 514.4 + 552.4 × E of Skopal and Chochol (1994). The zero epoch is that of the photometric minimum, when the cool giant is in front of the hot component.

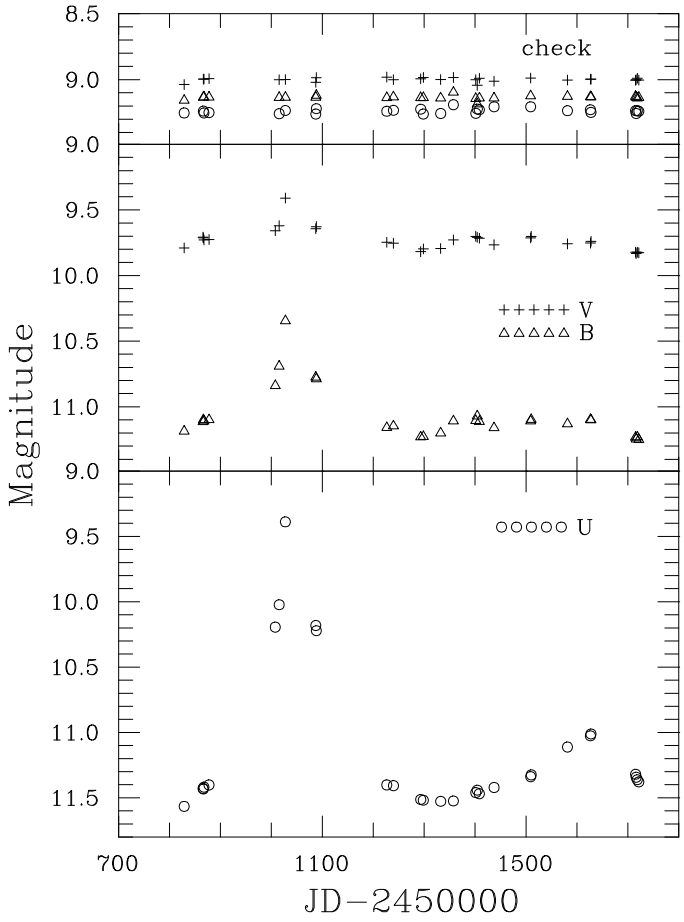

Figure 1. The UBV light curves of AG Dra

Figure 1 gives the three-colour light curve of AG Dra during the time of the observations. It is seen that the brightening of the star in 1998 is followed by a period of quiescence when the light in the B and V spectral regions reached its typical values during quiescent state. At that time the variations of the U light were probably determined by the orbital motion, since the smallest and greatest values are at the epochs of the orbital photometric minimum and maximum. Our data are not complete during the eruption, but they show that the light varied in all the colours and the amplitude of the variation was larger for the shorter wavelengths. The variation of the U magnitude indicates an increase by a factor of 4.8 of the light compared with the quiescent period before the 1994–1998 active phase. The B and V increase factors are 2.0 and 1.3.

The brightness at the time of the orbital minimum is greater than the brightness at the orbital minima during the quiescent stage before 1994 (Hric et al. 1993, Hric et al. 1994). Its increased value is determined by the greater number of the recombinating ions in the circumbinary nebula. Tomov et al. (2000) considered the U orbital variations of AG Dra

during quiescence. They came to the conclusion that the whole circumbinary nebula of this system is an ionized region (except the portion occulted by the cool star) as its hot stellar component is very luminous. Consequently, the growth of the luminosity alone will not lead to an increase of the number of the recombinating ions. It can be caused by a growth of the mass-loss rate of the giant star (Friedjung et al. 1998), and because of a mass outflow by the hot component during the active phase as well. On the other hand, there are no pronounced minima on the B and V light curves at the epoch of this orbital minimum, which is due to the different pattern of variability of the light of AG Dra in the region of these photometric systems (Bastian 1998, Friedjung et al. 1998).

The authors thank their colleague Dr. R. Zamanov for his helpful modification of the processing software.

References:

Bastian, U., 1998, *A&A*, **329**, L61
Friedjung, M., Hric, L., Petrik, K., Galis, R., 1998, *A&A*, **335**, 545
Hric, L., Skopal, A., Urban, Z., Komžík, R., Luthardt, R., Papoušek, J., Hanžl, D., Blanco, C., Niarchos, P., Velič, Z., Schweitzer, E., 1993, *Contr. Astr. Obs. Skalnaté Pleso*, **23**, 73
Hric, L., Skopal, A., Chochol, D., Komžík, R., Urban, Z., Papoušek, J., Blanco, C., Niarchos, P., Rovitis-Livaniou H., Rovitis, P., Chinarova, L.L., Pikhun, A.I., Tsvetkova, K., Semkov, E., Velič, Z., Schweitzer, E., 1994, *Contr. Astr. Obs. Skalnaté Pleso*, **24**, 31
Mikolajewska, J., Kenyon, S.J., Mikolajewski, M., Garcia, M.R., Polidan, R.S., 1995, *AJ*, **109**, 1289
Montagni, F., Maesano, M., Viotti, R., Altamore, A., Tomova, M., Tomov, N., 1996, *IBVS*, No. 4336
Petrik, K., Hric. L., 1994, *IAU Circ.*, No. 6073
Petrik, K., Hric. L., Galis, R., Friedjung, M., Dobrotka, A., 1998, *IBVS*, No. 4588
Skopal, A., & Chochol D., 1994, *IBVS*, No. 4080
Tomova, M., Tomov, N., 1998, *IBVS*, No. 4561
Tomov, N., Tomova, M., Ivanova, A., 2000, *A&A*, submitted