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PHOTOELECTRIC MINIMA OF SELECTED ECLIPSING BINARIES

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Nine new times of minima have been obtained photoelectrically for VW Cep, RZ Tau, V1073 Cyg, AG Vir and AI Dra at the Prince George Astronomical Observatory in the years from 1988 to 1998.

The AB component of the triple system VW Cephei is an eclipsing contact binary (W UMa type) that has been well studied in the last seventy-five years but requires constant monitoring because of its many period changes (Frasca et al. 1996, Jay & Guinan 1997). RZ Tau and V1073 Cyg are also contact binaries (Morris & Naftilan 1997 and Sezer 1996 resp.) whose periods may also be subject to change. AG Vir is a near contact binary (Shaw et al. 1996) and AI Dra is an Algol-type eclipsing binary (Singh et al. 1996).

Observations were made with either a 1978 vintage Celestron-8 (20 cm f/10 Schmidt-Cassegrain) or a 24" (61 cm) classical cassegrain operating at either f/15 or f/12. (The 24" telescope operated from 1984-88 at f/15. After the secondary mirror was stolen, the observatory in 1993 was relocated and a new secondary installed whereupon the 24" operated at f/12. The observatory is located at 123°50'51".5 W, 53°45'28".9 N).

The photometer used was either an OPTEC SSP-3 or a SSP-5a; both use analogue-to-digital electronics. The former utilizes a solid-state detector; the latter an uncooled Hamamatsu R1414 side-on photometer tube with a S-5 spectral response. The UBV filters match closely the standard Johnson filters. Instrumental magnitudes only (uncorrected for differential extinction and not transformed to the standard system) were used for determining the times of minimum. For each instrument, a 1 mm pinhole was used, corresponding to 103 arc seconds for the C-8, and 22.5 and 27.6 arc seconds for the 24" (for f/15 and f/12 respectively). In most cases, the filter was chosen that gave the greatest signal-to-noise ratio (usually B). Software written by the author (available gratis to OPTEC SSP users) records data, moves the filter slider, automatically reduces the raw data and displays a light curve on-line (with error estimates).

At all times, the object sequences sCVCs or sCVVCs (where s=sky, C=comparison and V=variable) were used.

The selection of comparison stars followed the recommendations of Henden & Kaitchuck (1982), page 208 or, in the case of RZ Tau and V1073 Cyg, previously used comparisons.

All data were plotted on a spreadsheet and a parabola fitted by least-squares. Points were rejected due to recorded errors such as the star slipping out of the pinhole, the appearance of thin cloud or aurora. Nevertheless, occasional obviously discordant points appeared due to unknown problems (such as undetected thin cloud); these were rejected.

Observations too close to advancing dawn were also found to be discordant possibly due to the fact that the linear interpolation that the software uses to calculate the sky contribution is inadequate in this situation (sky brightness rise at dawn appears to be roughly exponential).

After the least squares parabola was plotted with the data, adjustments were made to the parameters to see if the fit could be improved visually. (In this case, corrections were always less than 0.001 days.) To estimate the error, the time of minimum was adjusted until an obvious bad fit was seen; the difference in times of minimum was taken as the error.

In some cases, the method of Kwee & van Woerden (1956) was also used. Then, the actual values of the times of minimum by this method did not differ from those obtained by quadratic fitting by more than the estimated errors.

Table 1

Date (UT)	Star	Comparison	Fil.	Telesc.	Phot.	Minimum	Est'd	Type
						HJD _⊙	Error	I = Prim II = Sec.
88-07-20	VW Cep	SAO 9911	V	24" f/15	SSP-3	47 362.8616	0.001	II
90-09-26	VW Cep	SAO 9911	B	C-8	SSP-5a	48 160.7786	0.001	II
90-09-26	VW Cep	SAO 9911	V	C-8	SSP-5a	48 160.7777	0.001	II
91-05-19	VW Cep	SAO 9911	B	C-8	SSP-5a	48 395.8080	0.001	I
98-02-28	RZ Tau	GSC 1270 970	B	24" f/12	SSP-5a	50 872.8051	0.002	II
98-05-27	AG Vir	SAO 99924	V	24" f/12	SSP-5a	50 960.8170	0.003	II
98-06-04	V1073 Cyg	SAO 71340	V	24" f/12	SSP-5a	50 968.8565	0.002	I
98-07-07	V1073 Cyg	SAO 71340	V	24" f/12	SSP-5a	51 001.8627	0.0005	I
98-07-28	AI Dra	SAO 30200	B	24" f/12	SSP-5a	51 022.7949	0.0005	I

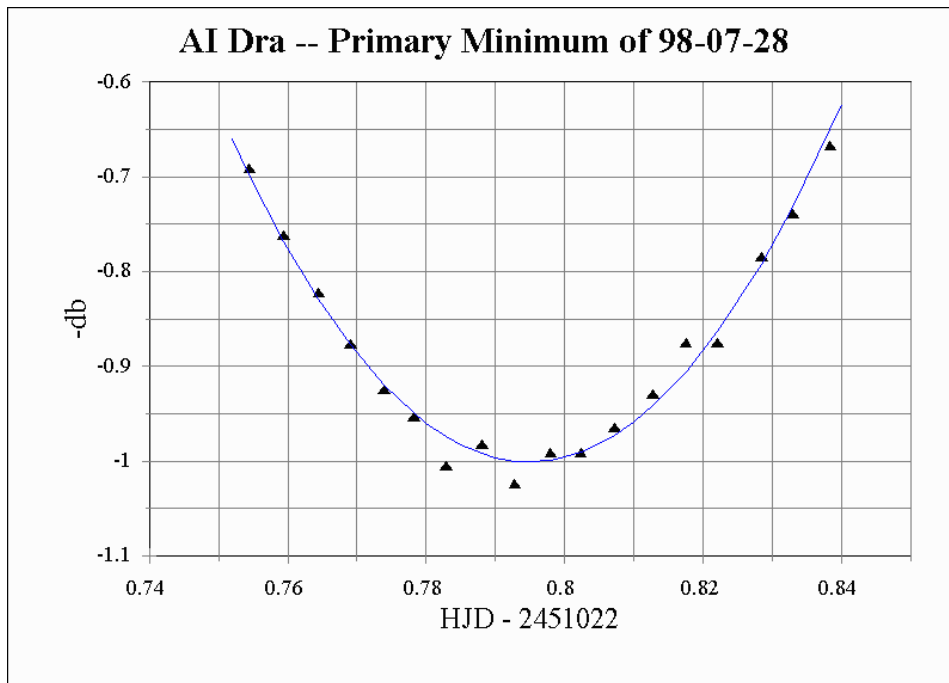


Figure 1.

The light curve for the last star (AI Dra) is shown in Figure 1.

Nine times of minimum have been successfully obtained for five stars yielding informa-

tion about period changes. The described procedure is vitally dependent upon photometric skies, which are not often obtained in Prince George. A differential technique, such as the RADS system at the University of Calgary (Milone et al. 1982) or CCD photometry on fainter stars (getting both the variable and comparison in one field) would yield data on less than photometric nights (all too common at this location).

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