OW Geminorum: Visual Observations of the 2002 Eclipse

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Abstract 124 visual observations of the long period eclipsing binary OW Geminorum were obtained by 10 AAVSO observers during its 2002 eclipse. Time of minimum was computed using the TINTAGEL computer program (Gaspani 1995). A least squares linear regression was applied to O–C values and the obtained slope confirms the known ephemeris:

$$\mathrm{Min}_{\mathrm{I}} = \mathrm{JD}\ \underset{\pm 0.4}{2415779.0} + \underset{\pm 0.03}{1258.59}\ \mathrm{E}.$$

Another least squares linear regression was applied only to the O–C values given by direct observations since its discovery (1988) and the following new ephemeris is suggested:

$$\mathrm{Min}_{\mathrm{I}} = \mathrm{JD}\ \underset{\pm 0.9221}{2452278.0880} + \underset{\pm 0.0260}{1258.6815}\ \mathrm{E}.$$

1. Introduction

The variable star OW Geminorum (HD 258878 = NSV 3005) is a long period Algol-type variable star (P = 1258.59 days = 3.45 years) and it was discovered photographically by AAVSO member Daniel Kaiser in 1988 (Kaiser *et al.* 1988). OW Gem shows a visual magnitude range between 8.0 and 10.2 and the ephemeris is:

$$\mathrm{Min}_{\mathrm{I}} = \mathrm{JD}\ 2415779.0 + 1258.59\ \mathrm{E}. \tag{1}$$

Since its discovery, three primary minima have been observed, in 1988, 1991, and 1995. Secondary minimum occurs at phase 0.23 with an amplitude of only 0.1 magnitude (Terrell *et al.* 1994). The spectral types of the components are the following: the brighter primary is a type F2 Ia-II, while the secondary is a late G-type star. Eccentricity of the system is high (0.52) and the duration of the minima are, respectively, 16 days for the primary and 30 days for the secondary (Derekas A. *et al.* 2002).

Since the discovery photographic observation of the eclipse obtained by Kaiser in 1988, it was possible to observe the phenomenon again in 1991, 1995, and 2002. Favorably placed eclipses occur every 7 years and the 2002 eclipse is only the second of the favorable ones since discovery; others occur near the conjunction with the Sun. The next eclipse will be in June 2005, again close to conjunction with the Sun, followed by a favorable eclipse in November 2008 (I have computed the time of minimum using the ephemeris formula (Kaiser *et al.* 1998) given in equation 1).

Examination of several Harvard patrol plates found five minima between 1902 and 1933 and examination of Sonneberg patrol plates found three minima between 1954 and 1964 (Fuhrmann 1989). Table 1 gives the (O–C) values with respect to the ephemeris (1); J.D. is the instant of the minimum in Julian Days, Cycle is the eclipse's number, O–C is the observation time minus predicted time (days), Reference is the source of data (Williams and Kaiser 1991; Hager 1996).

2. Observations

A primary minimum was predicted for January 3, 2002 (JD_C = 2452278.1100) and 124 visual observations were obtained from 10 AAVSO observers covering the period from December 6, 2001, to January 18, 2002. The observers' contributions are given in Table 2, and Figure 1 shows the light curve.

Measurements are used to compute the instant of observed minimum using the artificial neural network computer program TINTAGEL developed by A. Gaspani (Gaspani 1995); results are the following:

$$JD_O = 2452278.0880 \pm 0.9221 \qquad (2)$$

and the corresponding (O–C) (old JD_C is assumed using equation 1) is:

$$(O–C) = JD_O - JD_C = -0.0220 \text{ day.} \qquad (3)$$

3. Discussion

(O–C) value versus Cycle Number is shown in Figure 2, where squares are data obtained from plate examinations, and circles are data obtained since 1988. A least squares linear regression applied to the trend of O–C value versus the Cycle Number gives the equation with a slope of only –0.0015 ± 0.0181 (solid line in Figure 2); the ephemeris (1) can be used to predict further minima. If we consider only the (O–C) values obtained since 1988, a least squares linear regression applied to the trend of O–C value versus the Cycle Number gives the equation with a slope of 0.0915 ± 0.0206 (dashed line in Figure 2), and it is possible to define the following new ephemeris:

$$\mathrm{Min}_I = \mathrm{JD}\ \underset{\pm 0.9221}{2452278.0880} + \underset{\pm 0.0221}{1258.6728}\ E. \qquad (4)$$

4. Acknowledgements

I would like to give special thanks to all of the observers of OW Gem who contributed to this study. I wish to thank Dr. A. Gaspani, Osservatorio Astronomico di Brera (Milano, Italy), for the availability of his computer program TINTAGEL and for the valuable suggestions. Thanks also to Marvin E. Baldwin, AAVSO Eclipsing Binary Committee chairman, for the availability of the observations.

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Table 1. Historical archive of the eclipses of OW Gem.

JD	*Cycle*	*O–C*	*Reference*	*JD*	*Cycle*	*O–C*	*Reference*
2415779.4	0	+0.40	Harvard	2435916.0	16	–0.44	Sonneberg
2418295.8	2	–0.38	Harvard	2438435.0	18	+1.38	Sonneberg
2420812.5	4	–0.86	Harvard	2447243.4	25	–0.35	Kaiser
2422072.5	5	+0.55	Harvard	2448502.1	26	–0.24	AAVSO
2427105.6	9	–0.71	Harvard	2449760.857	27	–0.07	AAVSO
2427106.9	9	+0.59	Harvard	2452278.0880	29	–0.02	present work
2434658.0	15	+0.15	Sonneberg				

Table 2. Observers' contributions.

Observer Code	*Observer*	*Number of Visual Obs.*	*Observer Code*	*Observer*	*Number of Visual Obs.*
BSR	Baroni, Sandro	16	MNQ	Manna, Andrea	35
BON	Boninsegna, Roland	6	PFR	Puskas, Ferenc	11
CSM	Csukas, Matyas	3	REP	Reinhard, Peter	12
FSE	Foglia, Sergio	15	SFV	Salvaggio, Fabio	9
KUC	Kuchto, Serge	6	SET	Stephan, Chris	11

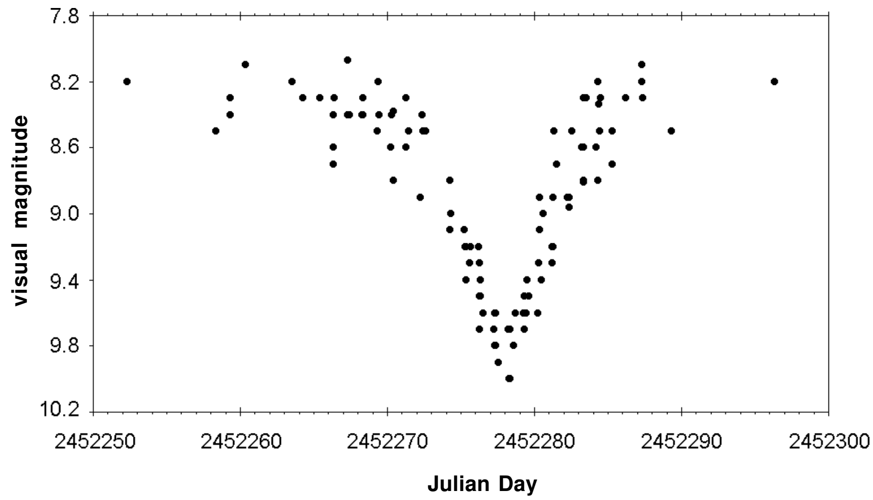

Figure 1. AAVSO light curve of OW Gem.

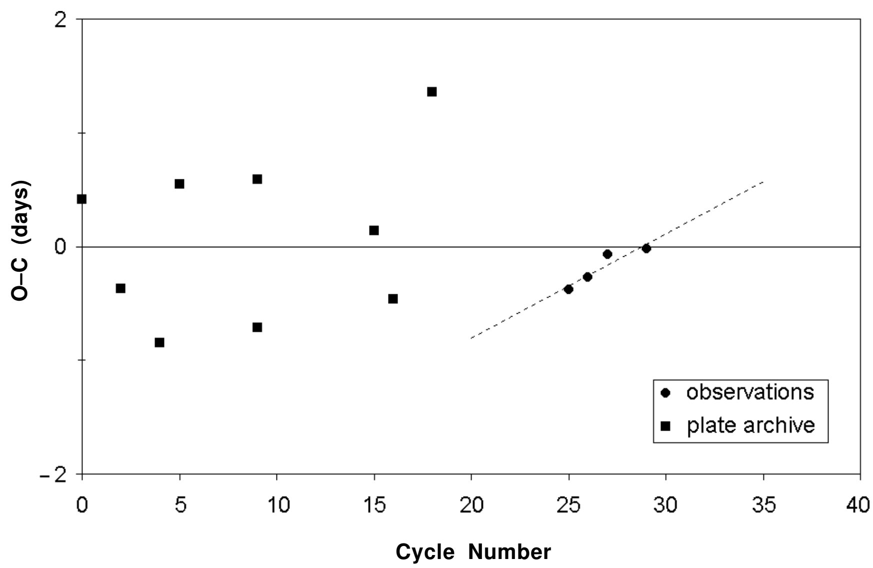

Figure 2. (O–C) values for OW Gem. Dashed line is from the old ephemeris.