GEOS EB 6

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LIST OF MINIMA AND ACCURATE DETERMINATION OF MEAN MINIMUM FOR VW CEP

1. LIST OF MINIMA

97 minima are given in this issue;they were determined in 1977 by the following observers :

R. BONINSEGNA	B - Dourbes	BNN
V. BONINSEGNA	B - Dourbes	LIS
J.F. LE BORGNE	F - Toulouse	FLB
C. PAMPALONI	I - Firenze	PMP
M. PENNA	I - Asti	MPN
E. PORETTI	I - Arconate	POI
Ph. RALINCOURT	F - Nantes	RAL
A. ROYER	F - Epinac	ROY

The table gives the current number,the star designation,the order of the minimum,the heliocentric time,the O-C,the number of observations and the initials of the observers.Imprecise timings and the corresponding O-C's are marked ":" . The O-C's are referred to the linear elements published in the GCVS (1969),except for VW Cep and V1010 Oph (GCVS 1976) for which these elements are too imprecise.

The methods of reduction which have been used are all based on symmetry:the timings have been analysed so as to palliate possible systematic errors caused by the different methods used.

2. CALCULATION OF THE MEAN MINIMUM

For those eclipsing binaries observed visually with a sufficient frequency as well as photoelectrically,the publication of visual minima must answer criteria of reliability and accuracy in order to be of some help.For this reason,GEOS will publish,from time to time and together with lists of minima,a first study in order to determine a reliable mean minimum and more accurate O-C's.Users are therefore requested to take these data in consideration when plotting graphs of variations of O-C's versus an ordinate scale of 0.01d . Users are also reminded that the observation of bright eclipsing binaries is intended by GEOS as complementary to the study of faint and/or less studied binaries.

General principles of the method of reduction - As a rule,this process will be performed only for stars for which a sufficient number of minima

have been determined by two observers or more (one observer exceptio= nally).The mean O-C and the standard deviation will first be determined for each observer,from which a weighted mean will be derived.As a matter of fact,each observer must be considered as an instrumental system generating a statiscal population.

If N observers have made n_i observations each,mean O-C's can be calculated from :

$$\overline{O-C}_i = \frac{\sum_{j=1}^{n_i} O-C_j}{n_i}$$

and N standard deviations from :

$$s_i = \sqrt{\frac{\sum_{j=1}^{n_i} (O-C_j - \overline{O-C}_i)^2}{n_i - 1}}$$

N probable errors on the mean from :

$$p_i = \frac{s_i}{\sqrt{n_i}}$$

N weighting coefficients from

$$w_i = \frac{1}{(k\ p_i)^2}$$

where k is an arbitrary coeffi= cient introduced so as to handle figures more easily.

The results of these determinations will then be used to compute a mean O-C using :

$$\overline{O-C}_w = \frac{\sum_{i=1}^{N} w_i\ \overline{O-C}_i}{\sum_{i=1}^{N} w_i}$$

with a probable error on the weighted mean given by :

$$p_w = \pm \frac{1}{\sqrt{\sum_{i=1}^{N} (1/p_i)^2}}$$

The elements thus calculated will be issued periodically for each star.With reference to the middle of the observing period,the time of mean minimum and the mean O-C will be given with error bars calculated on the level of confidence of 95% , i.e. $\pm\ 2\ p_w$.

3. MEAN MINIMUM OF VW CEP

The minima published in the present GEOS EB 6,as well as in the previous GEOS EB 3 (February 1979) make it possible to compute a better value for the mean O-C of VW Cep.Proceeding as described above, the following basic data have been calculated for each observer and reported in the table below :

Obs	n_i	$O-C_i$	s_i	p_i	w_i
FGR	19	-0.0027	0.0087	0.0020	25
MPN	27	-0.0023	0.0060	0.0012	69
POI	12	-0.0024	0.0023	0.0007	204
RAL	32	-0.0007	0.0083	0.0015	44

in which all O-C's are referred to the ephemeris of the GCVS (1976) with k=100 (see above,§ 2.) .

Using these values,it is possible to compute a weighted mean,thus $O-C_w = -0.0023$ d and $p_w = \pm 0.0005$ d $\cong 0.001$ d (probable error on the mean value) .

Starting from the published minima ,it is thus possible to determine the following elements :

MEAN MINIMUM (1975-1977) : JD 2443100.382 ± 0.001

O-C (GCVS 1976) : -0.002 ± 0.001 d

For the determination,the secondary minimum has been assumed to take place at $\varphi = 0.5$.

These values are perfectly consistent with the photoelectric elements; see for example : IBVS n° 1599 (Hopp,Witzigmann,Kiehl).

E. PORETTI

136	BX And	I	3446.284	+0.019		ROY
137		I	3457.259	+0.012		ROY
138		I	3482.283	+0.021		ROY
139	OO Aql	I	3365.377	-0.044		ROY
140		I	3366.393	-0.041	9	LIS
141		I	3366.397	-0.038	9	MPN
142		I	3366.401	-0.034	9	BNN
143		I	3367.406	-0.042		ROY
144		II	3388.456	-0.024		ROY
145		I	3404.402	-0.042		ROY
146		II	3425.436	-0.040		ROY
147		I	3432.279	-0.039		ROY
148		II	3447.233	-0.035		ROY
149		II	3456.349	-0.041		ROY
150	VW Cep	II	3308.411	-0.014	11	MPN
151		I	3314.408	-0.001	13	MPN
152		II	3335.428	+0.007	12	MPN
153		I	3336.394	-0.002	19	MPN
154		I	3336.399	+0.003	9	RAL
155		II	3342.378	-0.001	15	MPN
156		I	3342.519	0.000	19	MPN
157		I	3343.358:	+0.004	12	MPN
158		II	3343.494	+0.001	12	MPN
159		I	3344.471	-0.001	20	MPN
160		I	3346.416	+0.001	19	MPN
161		II	3350.452	+0.001	14	RAL
162		I	3361.448	+0.004	22	RAL
163		I	3363.386	-0.007	12	RAL
164		I	3363.394	+0.001	12	MPN
165		I	3364.495	-0.011	16	MPN
166		I	3364.514	+0.009	12	RAL
167		II	3364.628	-0.017	13	MPN
168		II	3365.465	-0.014	12	MPN
169		II	3365.489	+0.009	13	RAL
170		I	3366.445	-0.009	12	MPN
171		I	3366.453	-0.001	20	RAL
172		II	3366.598	+0.005	15	RAL
173		II	3367.431	+0.002	12	MPN
174		II	3367.437	+0.009	13	RAL
175		II	3369.378	+0.001	15	MPN
176		II	3369.378	+0.001	13	RAL
177		I	3369.512	-0.003	18	MPN
178		I	3369.516	0.000	19	RAL
179		II	3369.653	-0.002	7	MPN
180		I	3380.370	0.000	10	MPN
181		I	3390.386	-0.003	10	MPN
182		I	3392.336	-0.002	12	MPN
183		I	3395.398	-0.001	15	MPN
184		II	3398.320	-0.001	14	MPN
185		II	3410.292	+0.003	8	MPN
186		II	3420.314	+0.006	11	MPN
187		I	3427.412	+0.006	20	RAL
188		I	3430.474	+0.007	19	MPN
189		I	3431.304	+0.001	12	MPN
190		II	3445.364	+0.007	17	RAL
191		II	3476.258:	+0.009	16	RAL
192	TX Her	II	3249.472	-0.008	30	POI
193	u Her	II	3307.423	+0.002	14	POI
194		II	3311.544	+0.021	14	POI
195		II	3348.447	+0.006	16	POI
196	V566 Oph	II	2593.502	+0.022	8	RAL
197		II	2627.506	+0.026	10	RAL
198		II	2632.428	+0.033	13	RAL
199		II	2650.429	+0.010	13	RAL
200		II	3291.543	+0.035	7	BNN
201		I	3306.499	+0.039	14	POI
202		II	3307.513	+0.029	14	POI
203		I	3311.397	+0.022	12	POI
204		II	3312.429	+0.029	24	POI
205		I	3313.437	+0.014	11	POI
206		II	3314.474	+0.026	16	POI
207		II	3321.427	+0.015	16	POI
208		I	3322.472	+0.036	10	RAL
209		I	3327.379	+0.028	10	POI
210		I	3336.378	+0.014	9	POI
211		II	3344.376	+0.024	8	POI
212		I	3347.439	+0.015	18	POI
213		II	3348.476	+0.028	12	P0I
214		I	3361.377	+0.026	23	RAL
215		II	3364.442	+0.018	20	RAL
216		I	3365.473	+0.025	18	MPN
217		I	3365.483	+0.035	20	RAL
218		II	3369.379:	+0.039	18	RAL
219		I	3370.394	+0.030	8	BNN
220		I	3395.386	+0.034	11	POI
221	V1010 Oph	II	3307.477:	-0.011	8	POI
222		II	3311.443	-0.014	14	POI
223		II	3313.431	-0.010	8	POI
224	VV Ori	I	3494.394:	+0.004	10	PMP
225		I	3497.332	-0.029	16	PMP
226	ER Ori	II	3164.413:	-0.022		FLB
227		II	3181.346:	-0.026		FLB
228		II	3465.458	-0.016	10	POI
229		II	3482.391	-0.019	9	POI
230		II	3510.345	-0.009	13	POI
231		II	3512.461	-0.014	11	POI
232		II	3515.417	-0.018	15	POI