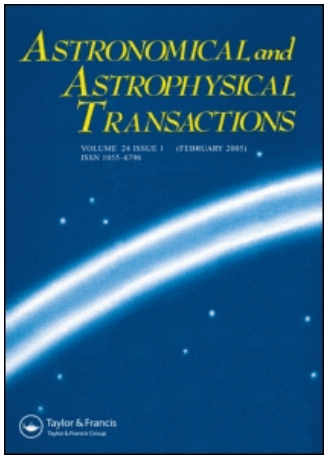

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Photometric investigations of dwarf nova stars

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PHOTOMETRIC INVESTIGATIONS OF DWARF NOVA STARS

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Long term data sets of photographic brightness observations are presented for 6 variables of the U Gem type. The outburst activity of the stars is studied. Two types of the outbursts is revealed for some of the investigated U Gem variables. The durations of the cycles between the outbursts of different types are found. The questions of the variable classification are considered.

KEY WORDS Cataclysmic variables, U Geminorum type stars

INTRODUCTION

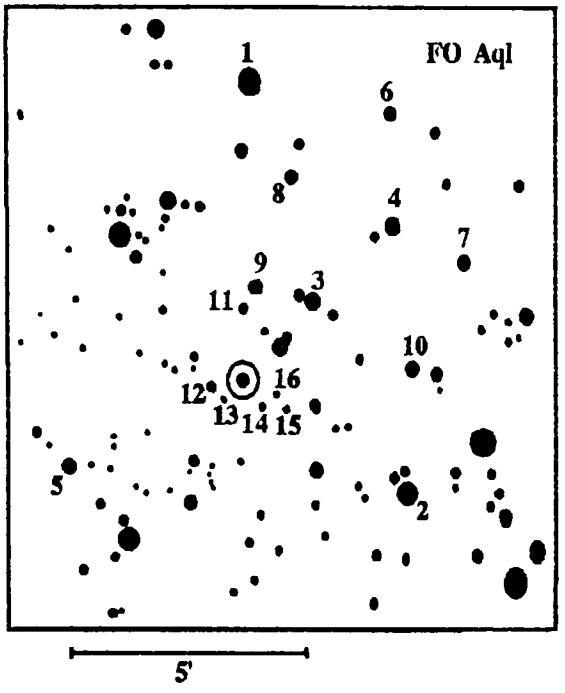
Visual brightness estimations on all photographic plates from the collection of Sternberg Astronomical Institute have been made for each of the six variables. The negatives were obtained in a band close to the B system on the 40-cm astrograph and on the Maksutov telescope of the Crimean Observatory of Sternberg Astronomical Institute. Long-term data sets allow us to determine the cycle duration between the outbursts and to classify the stars.

We found the existence of short-term cycles (14^d) for FO Aql. A valid value of the cycle duration of 26^d between "large" outbursts has been determined for FY Vul. This star cannot be classified as a U Gem system due to certain reasons considered below. We also have doubts concerning the classification of SW Vul as a U Gem star. There are two types of outburst for each U Gem system, which differ by amplitude, width and also by durations of the increase and decrease phases. The duration of the increase phase is shorter than that of the decrease one. The outbursts of the first type are characterized by greater amplitude and width in comparison with those of the second type. It should be noted that the cycle of periodicity of the burst has not been found. Time duration between the outbursts varies in a range of several days and the regularity in the periodicity has not been revealed.

FO AQL

The variability of FO Aql has been investigated earlier. Morgenroth (1938) observed this star as a variable with the magnitude changing in the range $13^m.5$–$15^m.6$ (pg). He estimated the cycle between the bursts to be $28^d.7$ and classified this source as a U Gem type variable. This star was classified as a dwarf nova system by Szkody (1985) on the basis of spectroscopic observations. Later on, Szkody *et al.* (1989) have determined the orbital period of FO Aql to be $\approx$ 5 h. They also noticed the contribution of a secondary component into the infrared spectral band. According to Szkody (1985), photoelectric magnitudes of the system are $U = 14^m.68, 14^m.84$; $B = 15^m.14, 15^m.23$; and $V = 14^m.74, 14^m.77$ in the mean brightness. These values are typical of U Gem type stars.

We have made 281 observations of FO Aql in JD = 2432740–2447750 (see Table 7 in Appex). The finding chart of FO Aql and of the comparison star used is presented



N	B
1	$13^m.32$
2	$14^m.04$
3	$14^m.36$
4	$14^m.98$
5	$15^m.19$
6	$15^m.19$
7	$15^m.68$
8	$15^m.89$
9	$15^m.91$
10	$16^m.08$
11	$16^m.86$
12	$17^m.10$
13	$17^m.39$
14	$17^m.45$
15	$17^m.56$
16	$18^m.13$

Figure 1 The finding chart of FO Aql and the comparison stars.

in Figure 1. Our observations confirm FO Aql to be an eruptive variable of the U Gem type with magnitude changes in the range $13^m.8$–$18^m.0$ (see Figure 2). This means that the average amplitude of bursts is as high as $4^m.2$. The analysis of the light curve evidences for two types of bursts with different amplitudes and durations. The type 1 (see Figure 3) bursts are characterized by smooth brightness changes

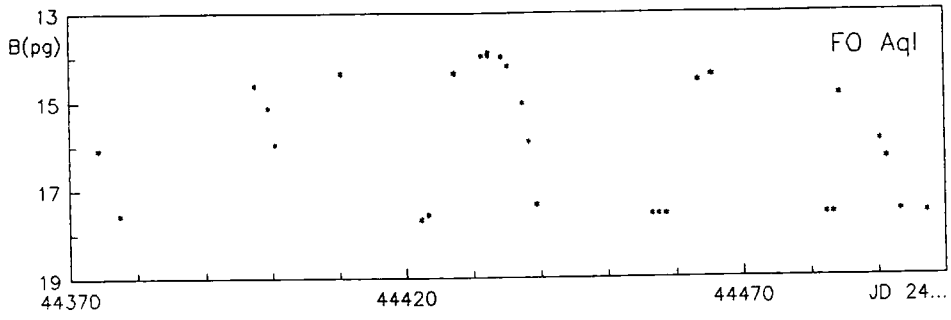


Figure 2 The light curve of FO Aql in JD = 2444370–2444500.

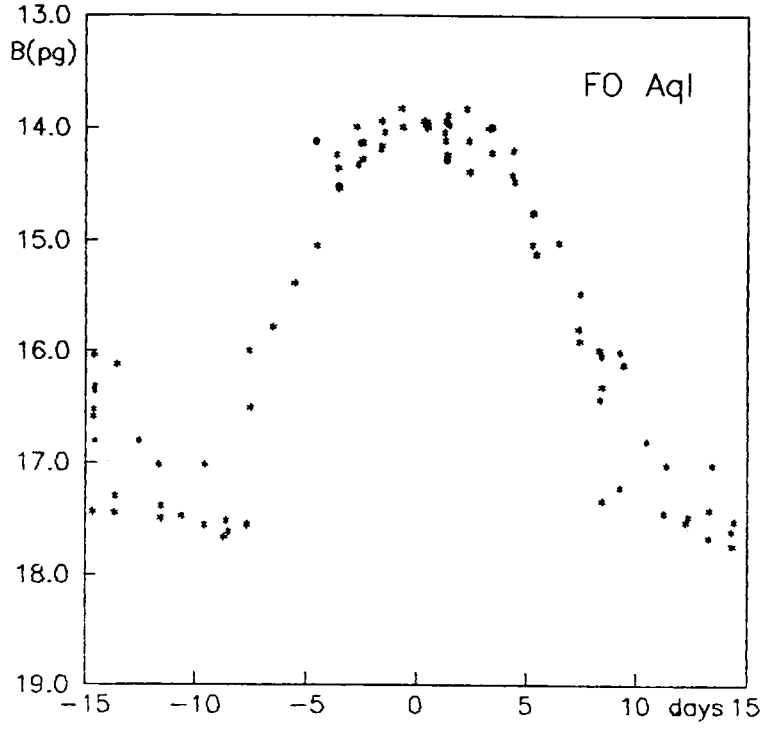


Figure 3 The summary light curve of the first type outburst of FO Aql.

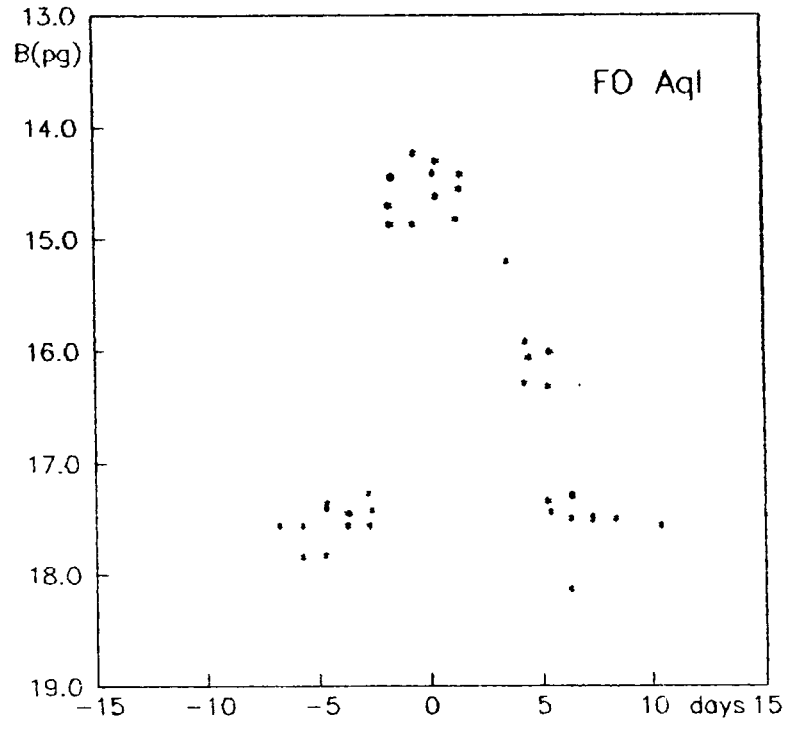


Figure 4 The summary light curve of the second type outburst of FO Aql.

and by a mean duration of $W \sim 18^d.5$. The brightness of the star reaches $13^m.8$ at the maximum of a type 1 burst and drops to $17^m.7$ in between, the amplitude of the bursts being thus $\sim 3^m.9$. The bursts of the second type (Figure 4) are characterized by a fast increase in a time period of one day and by a smooth decrease. They are shorter (their width is $W \sim 8^d$) and weaker, their magnitude at the maximum being $14^m.2$ (i.e., their amplitude is $0^m.4$ less than that of the type 1 bursts). In the Table 1 we present the moments of the maxima of FO Aql. A detailed analysis of the light curve shows that the bursts have occurred at intervals ranging from 14^d to 23^d (we have taken into account only continuous observations excluding missed bursts). The cycles with the duration 20^d–23^d are the most frequent. However, the lack of long enough observations without missed bursts has made it impossible to draw firmer conclusions about the behavior of the cycles and bursts.

V792 CYG

V792 Cyg was independently discovered as a variable by Miller and Wachman (1959). They made 509 observations in JD = 2417740–2436850.

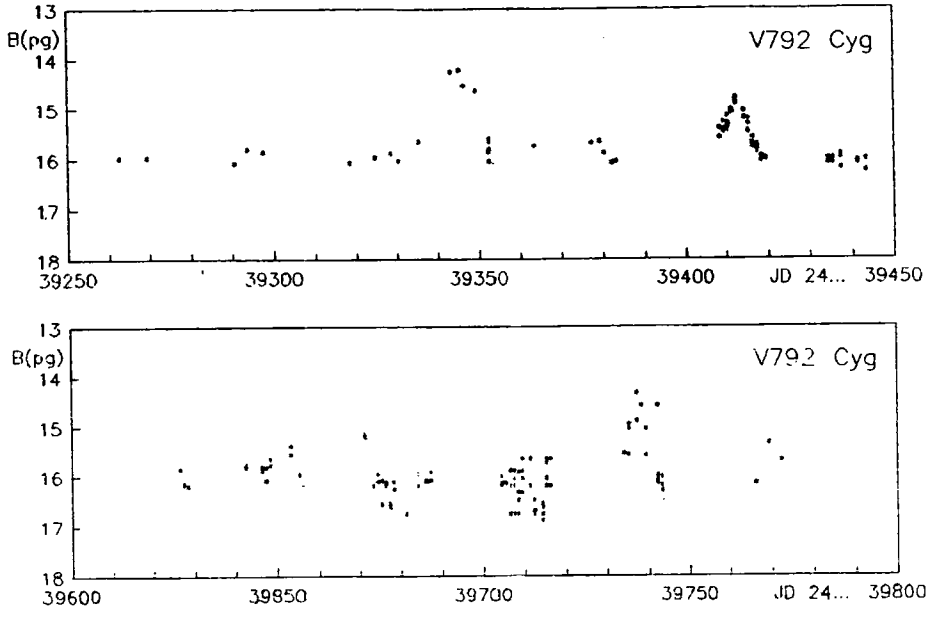


Figure 5 The light curve of V792 Cyg in JD = 2439250–2439450, JD = 2439600–2439800.

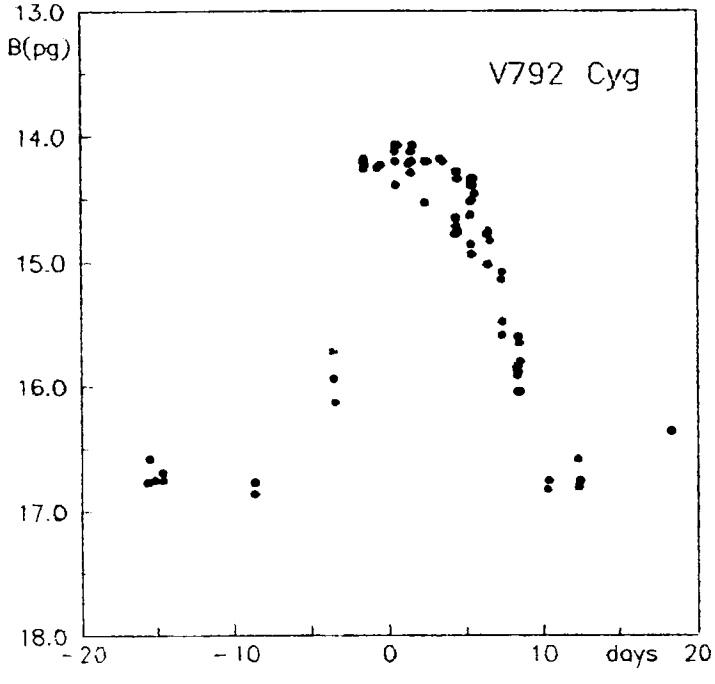


Figure 6 The summary light curve of the first type outburst of V792 Cyg.

We have continued the sequence of observations made by Miller and Wachman. We have made 476 observations of V792 Cyg in JD = 2436072–2448868 (see Table 8). We used the same comparison stars as Miller and Wachman (1959) did. All the analysis incorporated data reprocessing both observational sequences.

The magnitude of V792 Cyg changes in the range $14^m.0$–$17^m.0$, i.e., the amplitude is 3^m (see Figure 5). We have revealed two types of bursts. During a burst of type 1 (see Figure 6), the magnitude reaches $14^m.0$ at maximum (the burst amplitude is 3^m). Then the magnitude is almost unchanged during $\sim 6^d$ and after that it quickly drops during 5^d. The burst width is $\sim 13^d$. The bursts of type 2 are characterized by the magnitude of $14^m.6$, i.e., their amplitude is $\sim 2^m.4$ (see Figure 7). Their width is $W \sim 10^d$. The magnitude decreases during $\sim 7^d$ after a maximum.

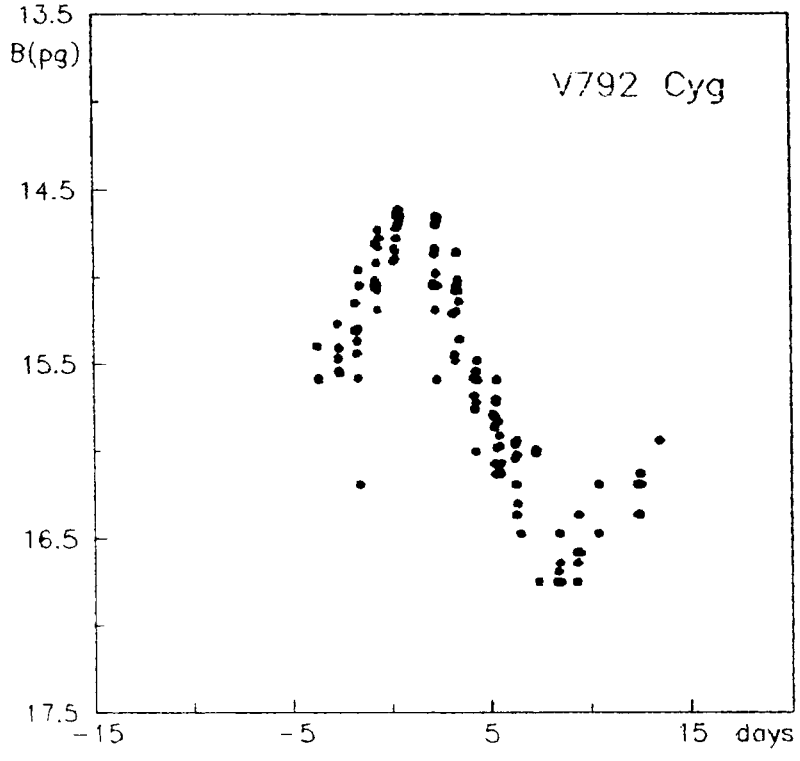


Figure 7 The summary light curve of the second type outburst of V792 Cyg.

The observed cycles are 24^d, 25^d, 28^d, 32^d and 33^d (if missing cycles are excluded). The moments of maxima and the cycles are listed in Table 2.

It should be noted that the dense observational sets during several nights allow us to reveal both the magnitude variability with the amplitude $\sim 3^m.0$ and a weak variation of the amplitude itself by $0^m.4$. These low-amplitude oscillations were observed during the burst phase as well as out of it.

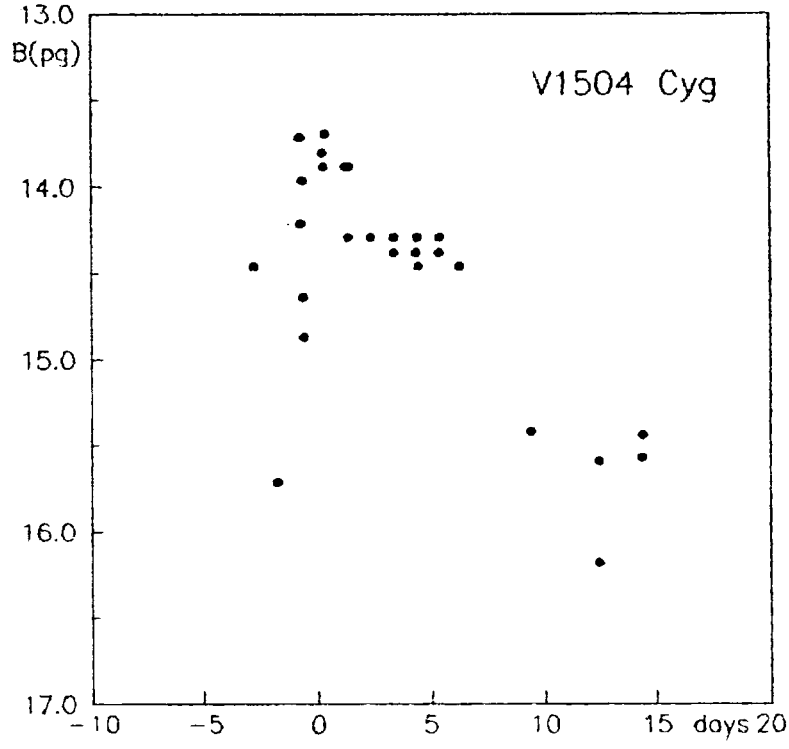


Figure 8 The summary light curve of the first type outburst of V1504 Cyg.

V1504 CYG

The variability of V1504 Cyg in the range of $14^{m}.5$–$15^{m}.5$ has been discovered by Beljawsky (1936). Later this star was investigated by Tsesevitch (1973). Irregular bursts with an amplitude of $2^{m}.5$ and time between the bursts of 3^{d}–14^{d} have been observed by Grocker (1978–1979). Rajkov and Yushchenko (1987) distinguish two types of the bursts. The type 1 bursts appear every $\sim 9^{d} - 10^{d}$, and those of type 2 occur once per $\sim 100^{d}$.

We have made 385 observations of V1504 Cyg in JD = 2433057–2447837 (see Table 9). We use comparison stars from the Atlas of Cataclysmic Variables (Khruzina and Shugarov, 1991). The magnitude changes are in the range $13^{m}.7$–$17^{m}.0$. After data processing, we have revealed two types of bursts. The bursts of type 1 (Figure 8) reach the maximum of $13^{m}.7$ during 1^{d}. The bursts duration is $W \approx 12^{d}$ and their amplitude is $\sim 3^{m}.3$. The bursts of type 2 (Figure 9) have a smoother increase ($14^{m}.4$ during $1^{d}.5$). Their width is $W \sim 3^{d}$ and the amplitude is $\sim 2^{m}.6$. The least interval between the bursts we observed is 7^{d} and the greatest one is 19^{d} (if missing bursts are excluded). The moments of maxima and burst cycles are presented in Table 3.

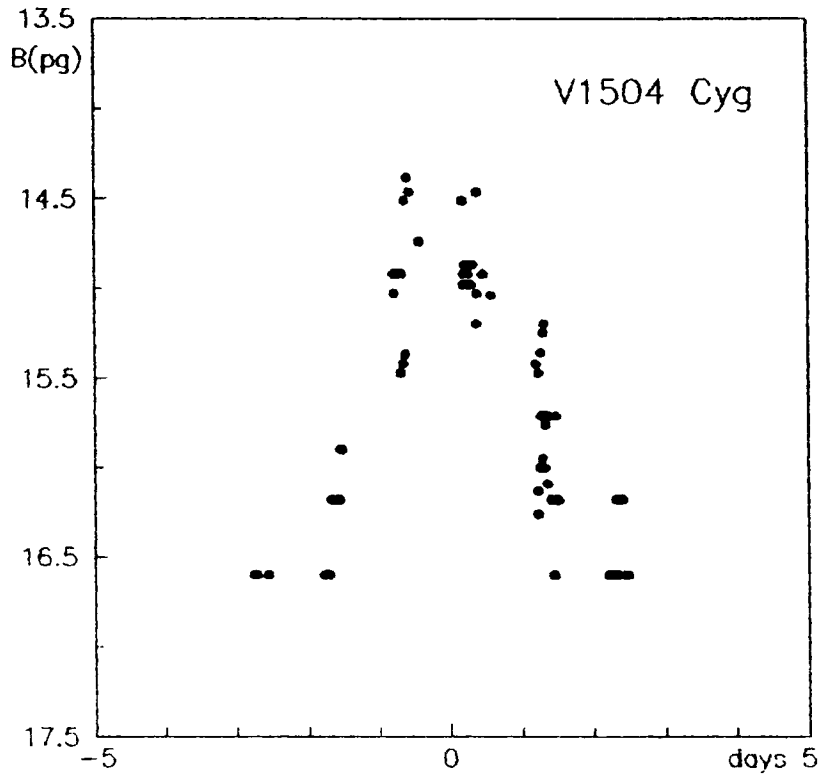


Figure 9 The summary light curve of the second type outburst of V1504 Cyg.

V363 LYR

V363 Lyr was discovered as a variable by Hoffmeister (1966). The magnitude changes in the range $15^m.5$–18^m. The star is blue in the Palomar Atlas of 19^m. magnitude (Hoffmeister, 1967). It was classified as a U Gem-type variable.

We made 333 brightness estimations of V363 Lyr from photographic plates in the range JD = 2433117–2448871 (see Table 9). The comparison stars and their magnitudes are taken from the Atlas of Cataclysmic Variables (Khruzina and Shugarov, 1991).

Data analysis shows that V363 Lyr is a weak star whose magnitude changes from $15^m.5$ to $18^m.3$, i.e., the mean amplitude is $2^m.8$. The weakness of the star precludes any definite conclusion on the burst type. So we present only a summary light curve (see Figure 10), which is characterized by the magnitude increasing during 2^d and a smooth decrease after it. The mean burst width is $W \sim 6^d$. The observed intervals between the bursts, if the burst missing is excluded, range between 7^d and 14^d. The moments of the bursts and their cycles are listed in Table 4.

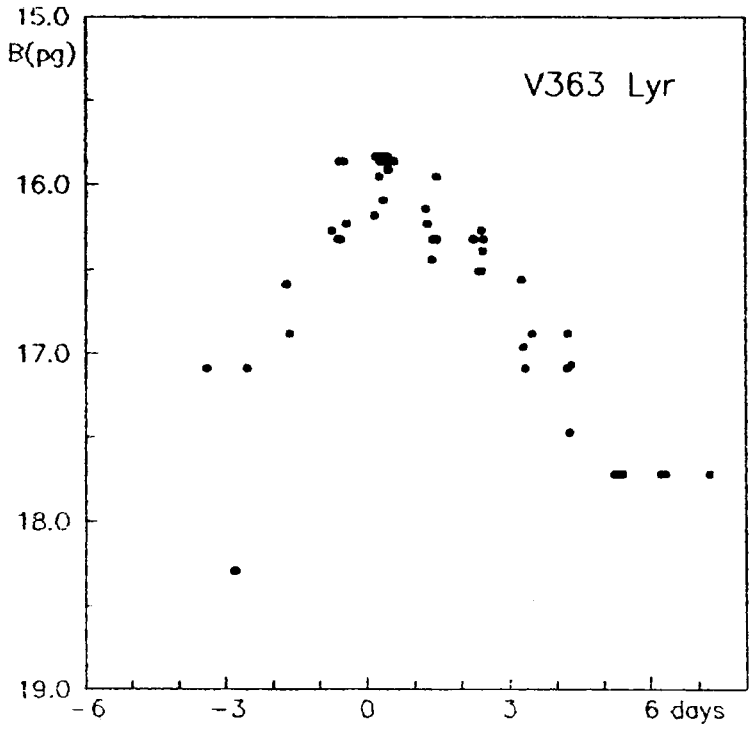


Figure 10 The summary light curve of the V363 Lyr outburst.

FY VUL

FY Vul was discovered as a short-term variable with the magnitude range $14^{m}.5$–$14^{m}.0$ by Hoffmeister (1940). Its study was continued by Richter (1960). According to his data, the magnitude varies from $13^{m}.4$ to $14^{m}.7$. The cycles between the bursts are found to be 30^{d}–70^{d} but the cycles of 45^{d}–60^{d} are more frequent (Richter, 1961). The author notes waves of variability with the magnitude of $0^{m}.4$–$1^{m}.3$. The star looks very blue on the POSS plates. Richter (1961) points out that the behavior of FY Vul is similar to that of S Vul. Meinunger (1965) classified it as a U Gem type of the Z Cam subtype (UGZ). Bruch (1983) also classified it as UGZ. He presented photoelectric magnitudes $V = 14^{m}.80$, $B - V = 0^{m}.53$ and $U - B = -0^{m}.65$ of the minimum JD = 2444128.

The analysis of our data shows that FY Vul is not a typical U Gem star. We have made 424 observations in the period JD = 2437118–2448092 (see Table 10). Comparison stars are taken from the Atlas of Cataclysmic Variables (Khruzina and Shugarov, 1991). Basically, the magnitude varies in the range $14^{m}.2$–$15^{m}.4$, i.e., with the amplitude $1^{m}.2$. However, brighter bursts were observed when the magnitude reached $13^{m}.7$. (see Figure 11). The summary light curve for these bursts

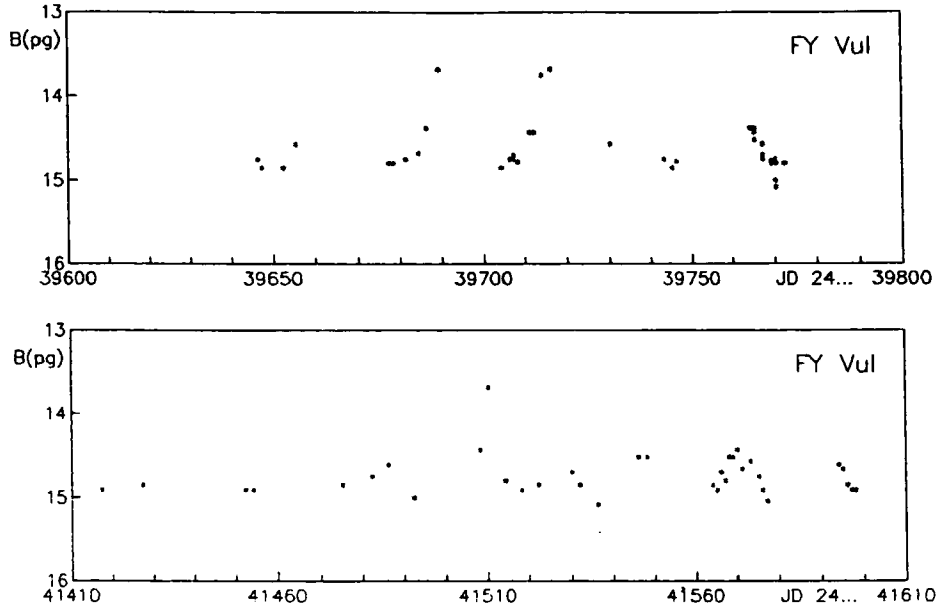


Figure 11 The light curve of FY Vul in JD = 2439600–2439800, JD = 2441410–2441610.

is presented in Figure 12. The bursts are characterized by a smooth brightness increase from $14^m.9$ to $14^m.3$ for 10^d or more, then there occurs a fast increase to $13^m.7$ for $\sim 2^d$, after that the brightness drops sharply to $14^m.3$ and then decreases smoothly to $\sim 15^m.0$. The burst width, without the pre-growth stage, is $W \sim 2^d - 3^d$. The moments of maxima are listed in Table 5. It should be noted that two consecutive bursts were observed at the interval of 26^d (the burst missing is excluded). Other cycles have not been analyzed due to the lack of a dense set of observations.

We note that one deep minimum was observed on JD = 2444040.394 when the brightness dropped down to $16^m.1$ that could be connected with a sharp decrease of accretion rate.

Such a burst activity is not typical of U Gem stars. FY Vul can be classified rather as a Nova like star. It is not excluded that its behavior is similar to that of VY Scl, the so-called "antiburst" CV.

SW VUL

Wolf (1924) has discovered SW Vul on 5 August 1923 as a star of 15^m magnitude. Until 1923 this star was not observed ($17^m.5$). So the author thought SW Vul to be a possible Nova. Zagar (1947) has classified it as a U Gem star. He observed this

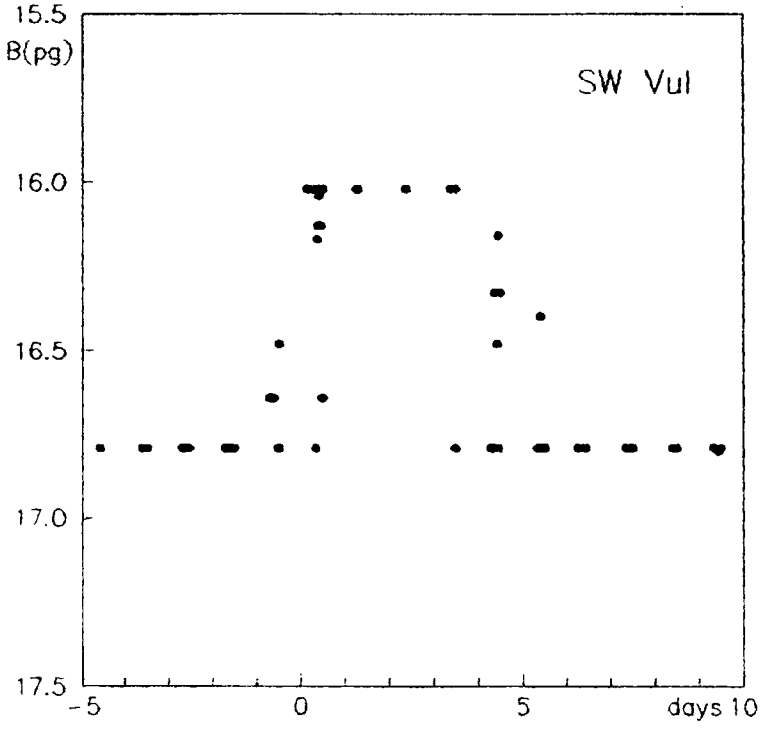


Figure 13 The summary light curve of the SW Vul outburst.

CONCLUSIONS

It is shown that, for a detailed and reliable analysis of the burst activity of CV, an extensive observational data base is required. Only after processing data from the plates of different observatories and after making systematical observations, some regularity of the CV behavior could be revealed. The lack of observations does not allow us to confirm or disprove the existence of cyclic changes of the period similar to those of the Sun which were described by Shakun (1987, 1988) and Bianchini (1990). We hope that the analysis of the light curves of many U Gem stars will allow us to reveal a new regularity in the burst activity.

Acknowledgement

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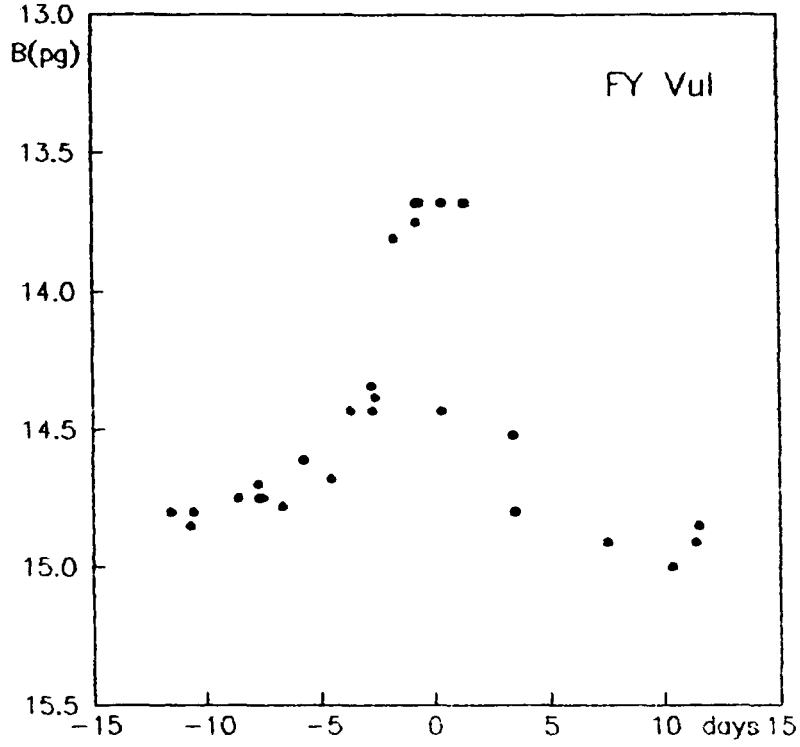

Figure 12 The summary light curve of the FY Vul outburst.

star as a variable with a magnitude variability in the range $15^{m}.5$–$18^{m}.0$ (pg). Rosino (1948) observed SW Vul with the magnitude varying in the range $15^{m}.6$–$18^{m}.2$ (pg).

We have made 361 estimations of the SW Vul brightness in the period JD = 2437118–2440092 (see Table 10). A comparison star has been taken from the Atlas of Cataclysmic Variables (Khruzina and Shugarov, 1991). The magnitude varies in the range $16^{m}.0$–17^{m}, so the burst amplitude is $\sim 1^{m}$, which is not typical of U gem stars. It could be assumed that, after a brighter burst (15^{m}) of 1923, the brightness is maxima dropped progressively: $15^{m}.6$–$14^{m}.5$ in 1947 and $16^{m}.0$ in 1961–1991. Taking into account a small burst amplitude, we suggest that SW Vul is a Nova-like variable. This can be confirmed indirectly by the blue color of the star on the POSS plates. Its magnitude is $\sim 18^{m}$, i.e., the total amplitude of the variability is $\sim 2^{m}$.

A study of SW Vul is difficult due to the weakness of the star. So the bursts can be characterized only qualitatively. The brightness increases quickly to 16^{m} during a day. Then a plateau near the maximum is observed for a period of $3^{d}.5$, after that the brightness decreases during 1^{d}–$1^{d}.5$ to a quiescent value. The burst width is 4^{d}–5^{d}. The summary light curve is presented in Figure 13. The probable burst cycles are 12^{d}–18^{d} (see Table 6). It is difficult to say anything more definite about the cycles due to the lack of observations.

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Appex: Tables

Designations:
P is the cycle duration between two consequtive outbursts.
: – An uncertain value;
/ – the maximum has been found using a rising outburst branch;
\ – the maximum has been found using a descending outburst branch;
• – the maximum has been found using the point of maximum brightness;
l(large) –the outburst of the first type;
s(small) – the outburst of the second type.

Table 1. FO Aql

JD	*Bursts type*	*Notes*	*B*	*P*
2437143:		/	–	
37197		*	14.4	
38210		*	14.0	
42637	l	*\	14.0	
42659		*	14.3	22
42960	l:	/*	14.0	
43038	l	*\	14.0	
43253:		\	–	
43326:	l:	\	–	
43349	l	/*	14.0	23
43400	s	/*\	14.4	
43416:		\	–	16
43430		/*	14.2	14
43666:		\	–	
43686	l	*\	14.0	20
43709:	l	/	–	23
43746	l	*\	13.8	
43781:		\	–	
43803:		\	–	22:
44016		*\	14.4	
44106	s	/ \	–	
44133	s	/ \	–	
44164		*	14.4	
44186	l:	*	14.1	22:
44342:		*	15.0	
44395:		\	14.6	
44410		*	14.4	15
44431	l	/*\	13.9	21
44464		*	14.4	
44486	s	/ \	–	22:
44766:		/	–	
44814	s	/*\	14.4	
44834	l	*\	13.8	20:
44854	s	/*	14.0	20
44898:		\	–	
45116:		\	–	
45175		/*	14.3	
45249:		\	–	
45491		*	14.3	

Table 1. (Continued)

JD	*Bursts type*	*Notes*	*B*	*P*
45531	l:	/*	13.9	
45549:		\	–	18:
45852:		*	14.5	
45909	s	/*\	14.2	
45942:		*	14.4	
47732:		\	–	
47751	l:	/*	13.9	19

Table 2. V792 Cyg

JD	*Bursts type*	*Notes*	*B*	*P*
2425408:		*	14.7	
32861		*	14.3	
32888:		*	14.8	27:
33452		*\	14.5	
33480		*	14.5	28:
33508	l	/*\	14.2	28
33541		*\	14.1	33
33716:		*	14.8	
33922		*\	14.5	
34132		*\	14.4	
34163:		*	15.0	31:
34226	l:	/*\	14.1	
34295		*\	14.1	
34596	l	/*\	14.1	
34626	l:	/*\	14.2	30:
34678		*	14.3	
34706		*\	14.2	28:
34744:		*	14.8	
34892	l:	/*\	14.1	
34918	l	/*\	14.2	26:
34950:		/*	14.4	32
34975:		\	–	25
35005:		\	–	30:
35066	l:	/*\	14.2	
35090:		\	–	24
35161:		\	–	
35185		*	14.3	24
35309		*\	14.5	
35341		*\	14.3	32:
35374		/*	14.1	33:
35428		*\	14.4	
36810	s	/*\	14.6	
36846:		\	–	36:
37166		/ \	–	
37557		*	14.6	
38562:		*	14.8	
38619:		*	14.8	
38904		*\	14.6	

Table 2. (Continued)

JD	*Bursts type*	*Notes*	*B*	*P*
39031	s	/ \	–	
39344	l	/*\	14.2	
39412	s	/ \	–	
39736	s	/ \	–	
40014:		/	–	
40056:		*	15.0	
40428		/*	14.5	
40832	l:	/*	14.3	
41865		*\	14.5	
41900		*	14.5	35:
42226		*	14.5	
42568:		*	15.0	
42596:		\	–	28:
43050:		*	14.8	
46623:		/		

Table 3. V1504 Cyg

JD	*Bursts type*	*Notes*	*B*	*P*
2434138	s	*	14.3:	
38697	s	/	–	
39348	s	/ \	–	
39410	s	/*\	14.5	7
39417	s	/*\	14.9	
39436:	s	/ \	14.5	19:
39652:	s	\	–	16:
39672	l	/*\	14.3	
39691	l	/	–	19
39713	s	/*\	14.4	
39741	s	/ \	–	
39766	l	*	13.7	
39973:	s	*	14.9	
40036	s	/*\	14.5	
40116	s	\	–	
40145:	s	*	14.9	
40152	l		13.9	7:
40412	s	*\	14.5	
43066	l	/*\	13.7	
44294	s	/ \		
44314:		*	14.7	
44399::		/*	–	
44408	s	/ \	–	9:
44849	l	/*\	13.7	
45057	s	*	14.3	
45171:	s	*	14.4	
45201:	s	*	15.0	
45488	s	*	14.1	
45532:	s	*	14.6	
47031:	s	*	14.3	

Table 3. (Continued)

JD	*Bursts type*	*Notes*	*B*	*P*
47329:	s	*	14.5	
47362:		/	–	
47375:		/	–	13:
47385:	s	*	14.5	10:
47747:	s	*	14.5	
47775:	s	*	14.3	
47796:	s	*	14.2:	
47829	s	/ \		

Table 4. V363 Lyr

JD	*Notes*	*B*	*P*
2439346::	*	16.3:	
39352::	*	16.1:	6:
39413	*	15.9:	
39646	*	15.6:	
39653::	*	16.3	7:
39678	*	15.9:	
39687::	*	15.9:	9
39707	*	15.5:	
39714::	*	15.9:	7
39734	*	15.9:	
39766	*	15.8	
40096	*	15.9	
40118	*	15.9	
40391	*	15.9	
40769	*	15.9	
43050	*\	15.9	
43062:	\	–	12:
44294	/*	15.9	
44409	*	15.9	
44437	*\	15.9	
44761:	\	–	
44814	/*	15.9	
44853::	*	–	
45205::	*	–	
45226:	\	–	
45495	*	15.9	
45520:	\	–	
45532:	*	–	12:
45613	*\	16.0	
45642::	*	–	
45665::	*	–	
45673::	*	–	8:
45703::	*	–	
45877::	*	–	
46289::	*	–	
46726:	\	–	

Table 4. (Continued)

JD	*Notes*	*B*	*P*
46941::	\	–	
47013::	*	–	
47019	*	15.9	6:
47303::	*	–	
47375:	*	15.9:	
47389::	*	–	14:
47437::	*	–	
47734	*	15.8	
47769	/ \	–	
47824	*	15.8	
47833:	*	–	9
48029	*	15.9	
48076	*	15.9	
48131	*	15.8	
48158::		–	
48400::		–	
48514	*	16.1	
48863::			

Table 5. FY Vul

JD	*B*	*P*
2437165	13.7	
37579	13.7	
39689	13.7	
39715	13.7	26
41511	13.7	
43729	13.7:	

Table 6. SW Vul

JD	*Notes*	*B*	*P*
2439292	•	16.0	
39387	*	16.0	
39703	*	16.0	
40087:	*	16.4	
40099:	/	–	12:
40428	/*	16.0	
40748:	/	–	
41177	*	16.0	
41478:	\	–	
41514:	/	–	
41531	*	16.0:	17:
41546:	\	–	15:
41578:	/	–	

Table 6. (Continued)

JD	*Notes*	*B*	*P*
41839:	/	–	
42216	*	16.0:	
42579	*	16.0	
42626:	*	16.4	
42642	*	16.0	16:
42930	*	16.0	
43303:	*	16.4	
43321:	*	16.5	18:
43751	*	16.2	
43866	*	16.0:	
44136	*	16.0	
44433	*	16.1	
44845	*	16.0	
45116	*	16.0	
45504	*	16.0	
45523:	*	16.2	
45846	*	16.0	
47035	*	16.1	

Table 7. FO Aql

JD	*B*	*JD*	*B*	*JD*	*B*
2432740.521	17.52	2443345.350	14.24	2443430.322	14.25
37115.451	17.30	346.332	14.33	449.186	17.67
116.465	17.67	346.517	14.13	450.176	17.62
135.433	16.08	347.355	14.19	668.468	14.73
136.429	16.08	347.505	14.04	670.462	15.70
137.427	(17.10	348.355	13.99	674.487	17.39
138.413	15.19	393.261	17.56	686.402	13.97
196.253	15.16	394.269	17.84	687.398	14.24
197.293	14.41	396.327	17.45	691.460	15.12
198.285	14.69	400.247	14.41	691.503	15.12
199.281	14.72	405.245	17.34	693.441	15.48
38210.456	14.04	406.279	18.13	694.432	16.04
42635.372	14.16	417.227	14.55	694.455	16.32
637.476	14.00	418.208	14.98	695.453	16.12
639.411	14.11	419.270	15.48	696.463	16.81
640.450	14.22	420.206	16.12	697.388	17.02
641.468	14.48	420.229	16.35	698.385	17.48
653.268	17.56	420.251	16.41	699.462	17.02
654.314	17.83	420.273	17.10	700.427	17.52
659.377	14.30	422.202	17.52	701.474	16.51
667.375	17.50	423.202	17.83	702.497	15.79
956.486	14.81	423.224	18.05	703.486	15.39
958.395	14.02	423.246	17.94	704.449	15.05
43017.301	16.05	423.266	17.90	705.472	14.54
017.404	(16.08	423.294	17.89	706.517	14.28
018.269	(16.08	424.224	17.49	728.450	15.68

Table 7. (Continued)

JD	B	JD	B	JD	B
018.311	(15.91	424.244	17.56	729.388	15.82
018.415	(15.91	424.265	17.62	730.333	15.91
019.278	(15.91	424.293	17.62	730.417	16.31
035.245	13.99	424.314	17.55	745.295	13.83
039.278	14.04	425.198	17.79	746.323	13.94
039.342	14.11	425.220	17.44	747.314	13.94
042.339	14.42	425.242	17.53	747.392	13.94
043.332	14.75	426.199	17.90	748.439	14.39
045.369	15.80	426.258	17.50	751.278	15.04
046.336	15.99	426.307	17.52	755.293	16.01
046.361	16.43	426.332	17.54	757.297	17.45
047.279	17.22	427.197	17.84	759.295	15.85
257.548	16.08	427.241	17.28	784.199	15.13
261.523	17.47	427.282	17.32	786.233	15.85
333.323	15.30	427.305	17.45	786.263	15.99
333.387	15.62	427.329	17.39	789.245	17.47
334.378	16.59	428.196	16.63	803.206	15.15
334.403	16.53	429.198	14.22	806.214	15.39
334.450	16.36	429.245	14.23	933.615	17.71
334.473	16.81	429.274	14.23	44017.504	14.36
335.351	17.45	429.298	14.30	021.466	16.09
340.511	17.62	429.322	14.31	021.507	16.88
341.339	17.55	430.200	14.26	024.494	17.45
342.470	(15.68	430.246	14.59	025.479	16.88
344.428	14.12	430.297	14.49	038.307	17.27
2444077.458	17.53	2444819.377	17.44	2445843.441	16.07
105.326	14.87	820.378	17.30	852.494	14.49
106.359	14.62	824.433	17.56	879.476	16.24
111.340	16.01	836.312	13.83	904.375	17.36
112.344	17.28	837.309	14.00	905.389	17.45
129.319	17.56	839.293	14.76	908.376	14.23
130.259	17.27	846.287	17.53	910.414	14.55
131.260	14.70	847.306	17.67	910.450	14.42
134.248	14.82	847.318	17.42	912.483	15.20
137.269	16.29	848.326	17.61	913.442	16.06
139.290	17.50	848.338	17.74	914.406	16.01
140.284	17.48	849.276	17.72	941.346	14.42
159.263	17.58	850.344	(16.86	46295.309	17.41
164.281	14.35	850.346	17.55	683.274	18.09
186.212	14.10	852.350	15.84	942.481	14.62
316.580	15.51	853.362	14.04	47711.489	17.15
342.533	15.03	853.366	14.27	715.499	17.38
374.406	(16.08	854.386	14.31	720.481	17.52
377.513	17.56	855.410	15.04	721.496	(15.91
397.487	14.63	875.258	17.75	722.438	17.56
399.428	15.13	876.271	17.55	722.441	17.53
400.498	15.96	877.258	17.95	731.369	15.14
410.448	14.36	877.278	(17.56	737.371	17.15:
422.323	17.67	900.196	14.96	739.473	17.50
423.335	17.56	905.204	17.56	746.493	15.53:
427.418	14.36	45116.496	14.48	749.379	13.94

Table 7. (Continued)

JD	*B*	*JD*	*B*	*JD*	*B*
431.487	13.97	118.486	15.37		
432.420	13.89	137.455	(15.91		
432.481	13.97	140.486	(17.56		
434.448	13.99	144.449	(15.91		
435.405	14.20	169.435	(17.45		
437.480	15.02	170.388	(17.56		
438.408	15.91	171.458	(16.08		
439.449	17.34	172.407	17.10		
456.392	17.56	173.427	14.30		
457.349	17.56	174.428	14.27		
458.422	17.56	196.354	18.13		
463.369	14.54	199.347	17.45		
465.386	14.42	251.278	15.19		
482.294	17.56	257.251	17.89		
483.296	17.56	258.264	17.56		
484.309	14.87	491.485	14.27		
490.315	15.92	499.498	17.95		
491.294	16.32	504.475	17.71		
493.296	17.51	523.432	16.00		
497.297	(17.56	528.450	14.14		
763.453	17.45	531.427	13.94		
764.427	15.84	550.370	14.51		
793.452	(16.86	553.399	15.41		
811.423	17.42	558.299	17.45		
812.382	14.44	579.371	17.48		

Table 8. V792 Cyg

JD	*B*	*JD*	*B*	*JD*	*B*
2436072.410	(14.59]	2438681.308	16.93	2439352.457	15.65
074.370	(14.59]	681.350	16.55	352.494	16.04
37118.373	15.34	825.561	15.41	352.529	15.80
135.478	16.10	876.434	16.93	363.393	15.74
137.470	15.54:	886.419	16.83	377.318	15.68
138.454	15.57	887.527	16.19	379.268	15.65
160.313	16.04	904.398	14.64	380.384	15.88:
162.291	15.15	907.466	15.65	382.247	16.08
164.334	14.74	914.400	16.95	383.302	16.05
166.324	14.64	918.466	(16.75	408.282	15.40
168.376	15.06	938.389	16.09	408.319	15.58
175.329	16.56	939.422	15.99	408.357	15.59
176.508	16.70	943.391	16.61	409.323	15.27
194.315	15.11	965.426	16.18	409.357	15.47
218.212	16.08	967.501	16.12	409.391	15.41
525.501	16.75	969.426	16.35	410.209	15.15
527.509	16.66	971.478	16.26	410.243	15.31
546.350	15.99	973.489	16.01	410.277	15.44
549.443	15.14	978.490	15.68	410.312	15.37

Table 8. (Continued)

JD	B	JD	B	JD	B
557.375	14.64	981.492	15.77::	410.346	15.30
761.503	(15.08	998.424	16.12	411.211	15.05
845.487	15.53	39029.412	16.19	411.246	15.02
854.500	(15.65	030.243	14.81	411.281	15.07
876.456	16.16	030.290	14.92	411.318	15.08
885.413	16.90	030.337	14.80	411.353	15.05
902.299	16.98	030.382	14.73	412.208	14.91
38142.521	16.84	031.353	14.72	412.241	14.84
176.420	(15.65	033.290	14.87	412.274	14.85
196.447	16.36:	033.336	14.84	412.310	14.90:
227.344	(16.75	033.383	14.98	412.343	14.78
255.415	16.30:	034.327	15.08	414.205	15.04
260.390	16.45:	034.371	15.20	414.242	15.05
261.408	16.82	035.317	16.00	414.278	15.04
268.374	16.80	185.592	15.58	414.316	15.19:
281.267	16.60	262.515	15.97	414.351	15.19
289.432	(15.08	269.468	15.96	415.197	15.21
290.343	16.75	290.422	16.08	415.230	15.21
326.227	16.23	293.469	15.80	415.262	15.31:
552.486	16.68	297.417	15.85	415.294	15.45
560.452	15.03	318.344	16.07	415.328	15.48
562.421	14.79	324.467	15.97	416.229	15.58
619.455	14.84	328.510	(15.88	416.263	15.68
676.241	(15.88	330.455	16.04:	416.298	15.76
676.271	16.59	335.498	15.65	416.343	15.72
676.310	16.54	343.292	14.25	417.196	15.79
678.213	16.33	345.298	14.22	417.229	15.80
678.254	16.49	345.349	14.21	417.262	15.86
680.249	16.64	346.350	14.53	417.294	15.80
680.289	16.87:	349.302	14.63	417.328	15.72
680.330	(16.19	352.328	15.85	418.237	15.95
680.378	16.59	352.418	15.60	418.270	16.04
2439418.305	15.96	2439686.387	16.08	2439737.328	(14.34
418.335	15.95:	686.420	16.11	738.408	(14.59
418.370	15.94	687.448	16.08	739.408	15.59
419.333	16.01	687.480	15.92	739.441	15.05
419.367	15.99	704.362	16.15	742.276	16.07
434.189	16.00	704.394	16.00	742.311	16.13
434.222	16.08	704.426	16.19	742.345	15.98
434.255	16.08	704.458	16.15	742.380	(14.59
435.189	16.08	705.371	16.12	743.318	16.19
435.242	16.05	705.408	16.15	743.350	16.02
435.275	16.09	706.443	16.75:	743.384	16.30
435.307	16.00	706.475	15.88::	766.298	16.15
437.201	15.92	706.507	16.19::	769.339	15.34
437.234	15.98	707.364	16.04::	772.326	15.69
437.267	16.19	707.398	15.88::	945.578	16.64:
441.185	16.04	707.437	(16.19	953.565	16.39
441.218	16.04	707.479	(16.75	965.391	(16.75
441.250	16.09	708.382	16.47	965.498	16.15
443.238	16.02	708.414	(16.75	966.469	16.16

Table 8. (Continued)

JD	B	JD	B	JD	B
443.271	16.25:	708.445	16.47	966.498	16.24
553.500	(15.08	708.477	15.92:	968.470	16.19
626.523	15.85	708.509	16.32:	968.495	16.61
627.502	16.15	709.368	15.90:	969.449	16.44
628.486	16.19:	709.402	16.33:	969.485	16.74
642.459	15.76	709.436	16.04	969.511	16.26
642.493	15.82:	709.470	(15.65	969.535	16.19
646.377	15.81	711.411	(15.65	970.526	15.88
646.413	15.88	711.443	16.19:	970.549	15.84
647.371	15.82	711.476	(15.65	972.472	15.08
647.403	16.08	712.381	16.47	972.496	15.27
648.385	15.65	712.419	16.75:	973.527	15.55
648.418	15.77:	712.452	16.68	975.524	(15.08
653.375	15.56	714.386	16.87	994.417	16.68
653.407	15.39	714.420	16.75	994.441	16.56
655.444	15.96	714.452	16.75	998.420	16.68
671.379	15.15	714.484	16.54	999.440	16.19
671.411	15.20	714.516	16.61	999.465	16.26
673.376	16.19:	715.407	16.04	40000.461	16.98
674.356	16.11	715.439	16.19	000.483	16.86
674.389	15.96	715.471	15.73	004.404	16.26
675.383	16.56	715.503	16.04:	004.431	16.87
675.415	16.09	715.535	(15.65	004.454	16.47:
676.427	16.19	716.467	16.19	013.490	15.02
676.465	16.13	716.504	16.19	013.512	15.70
677.373	16.54	716.546	(15.65	014.513	14.91
677.405	16.61	734.387	15.54	033.436	16.75:
678.348	16.12	734.423	15.55	037.334	16.75
678.380	16.26	735.339	15.58	056.477	14.96
681.398	16.75:	735.372	14.96	085.306	15.77
684.422	16.19	735.408	15.05	094.377	15.88
684.454	15.95:	737.290	14.90	095.437	16.75

Table 8. (Continued)

JD	B	JD	B	JD	B	JD	B
2440095.477	(15.88	2441513.460	16.40	2442579.343	16.47:	619.312	15.76
117.353	15.88	517.495	16.58	596.390	15.01	619.495	15.65
118.308	16.15	519.508	16.12	599.500	15.01	620.467	16.11
122.328	16.81	521.517	16.68	600.487	15.15	622.318	14.86
123.314	16.10	531.304	16.04	606.453	16.12	622.484	14.78
152.274	16.15	541.493	16.08	608.436	16.14	623.316	14.83
156.367	16.15	547.369	16.32	609.526	16.15	623.491	14.91
365.521	16.26	801.519	(16.75	610.433	16.28	624.327	14.90
381.455	15.13:	806.499	(15.88	626.427	16.15	624.467	14.96
382.501	16.02	829.420	15.55	632.533	15.93	624.499	14.76
386.484	16.83	836.431	(16.75	641.436	15.15	935.408	(15.88
387.450	16.75	837.510	16.64	642.509	15.68	325.495	(15.88

Table 8. (Continued)

JD	*B*	*JD*	*B*	*JD*	*B*	*JD*	*B*
387.472	16.78	838.462	16.54	656.326	16.30	776.350	14.76
412.480	16.00	840.459	(16.75	658.340	16.39	075.500	16.98:
413.503	16.47	843.488	(16.19	660.364	16.12	091.437	16.90
422.401	16.53	861.458	16.36	665.308	16.08	867.337	15.05
425.439	(15.65	865.476	14.46	667.319	16.19		
427.438	15.19	867.488	14.78	668.342	16.32		
428.482	14.49	871.491	16.19	684.290	16.29		
744.436	(15.65	873.479	(16.75	868.479	15.85:		
744.460	16.33:	875.488	(16.75	872.577	16.23		
764.429	16.50	887.382	16.15	920.478	16.09		
768.426	16.73:	888.508	(15.88	934.352	16.08		
769.433	16.75	890.455	(15.88	936.514	15.88:		
769.469	16.75	895.380	(16.75	950.455	15.81		
770.377	16.13	896.489	(15.08	956.450	16.16		
775.422	16.26	900.528	14.50	964.429	16.12		
779.390	16.58	902.454	14.52	965.503	16.12		
779.420	16.19	915.341	16.33	988.411	16.87		
779.454	16.75	917.341	16.26	43036.297	16.14		
793.341	16.08:	920.399	16.55	049.349	14.80		
799.443	(16.19	923.426	16.36	050.325	14.76		
801.387	16.38	927.395	16.32	063.239	(14.59		
807.483	16.75	929.405	(16.75	064.259	(16.75		
808.451	16.19	932.409	16.81	065.262	16.19		
810.498	(15.65	42212.459	15.71	066.244	16.53		
822.365	16.75	217.457	16.54	067.250	(15.65		
828.429	16.19	219.468	16.75	072.265	16.19		
829.401	14.57	226.379	14.56	345.489	16.26		
834.423	14.34	254.497	15.92	435.205	(15.88		
834.459	14.49	254.530	15.88:	702.311	15.70		
41417.526	15.18	301.236	16.07	936.596	(15.65		
447.519	16.98	507.549	16.19	44192.238	16.87		
452.484	16.81	509.549	16.10	436.457	16.98		
454.520	16.64	519.519	(15.08	45503.397	16.47		
456.500	16.71	541.512	16.16	46613.325	16.19:		
477.492	16.75	543.506	(16.19	613.467	16.37		
481.484	16.75:	547.464	16.10	616.319	15.72		
483.485	16.82	565.424	15.65:	617.311	15.85		
486.454	16.67	568.507	15.00	617.479	(15.08		
492.430	16.68	578.489	16.09	618.500	15.57		

Table 9. V1504 Cyg, V363 Lyr

JD	*V1504 Cyg* *B*	*V363 Lyr* *B*	*JD*	*V1504 Cyg* *B*	*V363 Lyr* *B*
2433057.479	15.36	–	2439415.262	(16.60	–
117.509	–	(16.56	415.294	16.60	–
776.434	–	(16.56	415.328	16.18	–
34138.415	14.31:	(15.86	416.229	15.03	(15.86
519.421	(14.46	(15.86	416.263	14.92	16.56:

Table 9. (Continued)

JD	*V1504 Cyg* B	*V363 Lyr* B	JD	*V1504 Cyg* B	*V363 Lyr* B
36520.206	16.60	–	416.298	14.92	(15.86
924.202	16.80:	–	416.343	14.92	(15.86
924.248	16.18	–	417.229	14.92	(15.86
38695.198	16.18:	–	417.262	14.92	(15.53
696.215	15.47:	–	417.294	14.98	(15.53
39345.349	17.00:	16.32:	417.196	15.20	(15.86
346.350	16.18	16.32:	417.328	14.98	(15.53
349.301	16.00	(15.86	418.237	16.13	(15.86
351.335	16.18:	–	418.270	16.00	(16.88
351.377	(16.18	–	418.305	15.95	(16.56
351.416	(16.18	–	418.335	16.00	(16.32
352.328	17.00:	(16.32	418.370	16.09	(15.86
352.418	16.90:	(16.56	419.333	16.60	(15.86
352.457	16.80:	16.09:	419.367	16.18	(15.86
352.494	16.80:	(16.32	434.189	14.69:	–
352.529	16.60	(15.53	434.222	14.69:	–
363.393	15.61	(15.86	434.255	14.69:	–
408.282	(16.18	(15.86	435.189	14.69	(15.86
408.319	16.18:	(16.32	435.242	14.74	(15.86
408.357	16.18:	(16.56	435.275	14.64	(15.86
409.323	15.47	(15.86	435.307	14.55	(15.53
409.357	15.42	(15.86	437.201	14.83	(15.53
409.391	15.37	(15.86	437.234	14.87	(15.86
410.209	14.51	(15.86	437.267	14.87	(15.86
410.243	14.87	(16.32	441.185	16.60	(15.86
410.277	14.92	(16.56	441.218	16.18	(15.86
410.312	14.87	(16.56	441.250	16.60	–
410.346	14.87	(16.56	443.238	16.60	15.56:
411.211	15.42	(16.32	443.271	(16.60	(15.86
411.246	15.47	(16.56	627.502	16.18:	–
411.281	15.71	16.56:	628.486	(16.60	–
411.318	15.71	(15.86	642.459	(16.18	–
411.353	15.71	(15.86	642.493	(15.71	–
412.208	16.60	16.32:	646.377	(16.60	15.56:
412.241	16.60:	15.86:	646.413	16.60	(15.56
412.274	(15.47	15.86:	647.371	16.13	16.32:
412.310	(16.60	(15.86	647.403	16.80:	–
412.343	16.18	(15.86	648.385	(16.18	–
414.205	(15.71	(15.86	648.418	(15.47	–
414.242	16.60:	(15.86	653.375	14.83	16.32:
414.278	16.60:	(15.53	653.407	15.25	16.32:
414.316	16.18:	–	655.444	16.60:	(15.86
414.351	16.18:	(15.53	671.379	14.64	–
415.197	16.18:	–	671.411	14.87	–
415.230	16.60:	–	673.376	14.29	(15.86
2439674.356	14.29	–	2439715.439	16.60	(16.32
674.389	14.29	–	715.471	(16.18	(16.32
675.383	14.38	(15.86	715.503	(16.18	–
675.415	14.29	16.32:	715.535	(15.71	–
676.465	14.46	(15.86	716.467	(14.92	(15.86
677.373	14.38	(16.56	716.504	(15.71	(16.32

Table 9. (Continued)

JD	*V1504 Cyg* B	*V363 Lyr* B	JD	*V1504 Cyg* B	*V363 Lyr* B
677.405	14.29	(15.86	716.546	(14.92	–
678.308	–	15.86:	734.387	16.60	15.86:
681.398	15.42	16.32:	734.423	(16.18	–
684.422	16.18	(15.53	735.339	(16.18	–
684.454	15.59	(15.53	735.372	(16.18	15.86:
686.387	15.57	(15.86	735.408	(15.71	(16.32
686.420	15.44	(16.32	737.290	(16.18	(15.86
687.448	15.20	15.86:	737.328	(14.92	–
687.480	14.92	15.86:	738.370	(14.46	–
703.393	16.18	(16.56	738.408	(14.46	–
703.441	16.18	(16.32	739.408	(16.18	(15.86
704.362	16.18	(16.32	739.441	(16.18	–
704.394	16.18	–	742.276	15.36	–
704.426	(16.18	–	742.311	15.25	–
704.458	15.42	–	742.345	15.76	–
705.371	16.18	–	742.380	15.71:	–
705.408	16.18	–	743.318	16.18	(16.32
706.443	(15.71	–	743.350	(15.71	–
706.475	(15.47	–	743.384	(15.71	–
706.507	(15.47	–	766.298	13.71	15.83
707.364	16.60	(16.32	769.339	(16.60	(16.56
707.398	(15.71	–	970.549	16.60	(16.32
707.479	(16.18	15.53	973.527	14.92	(16.56
708.382	16.18:	–	975.524	15.71	–
708.414	(15.71	–	994.417	16.18	(17.72
708.445	(16.18	–	994.441	16.16	16.56:
708.477	(15.71	–	998.448	16.60	(17.09
708.509	15.59:	–	998.472	17.10:	(17.09
709.368	(16.18	–	999.440	17.10:	(16.88
709.402	(16.18	–	999.465	17.10:	(16.88
709.436	16.18:	–	40000.461	16.60	(16.88
709.470	(16.18	–	000.483	16.60	(16.56
711.411	15.71:	–	004.431	16.60	–
711.443	15.90	–	004.454	(15.71	–
711.476	15.90	–	007.448	16.60	17.09
712.381	14.51	–	007.472	16.18	16.56
712.419	14.38	–	007.495	16.60	16.88
712.452	14.46	–	013.490	16.09	–
714.386	15.71	(16.32	013.512	16.18	–
714.420	16.18	(16.32	033.436	(16.18	–
714.452	16.60	(16.32	034.443	(15.71	–
714.484	16.18	–	036.406	14.46	–
714.516	16.18	15.86:	037.334	15.20	–
715.407	16.18	(16.32	056.477	16.80:	16.88:
2440060.525	16.18	(15.86	2444294.600	15.04	15.86
064.517	16.90:	(16.56	314.585	14.69:	(17.72
094.377	16.60	–	315.585	15.47	(18.29
095.437	16.90:	–	348.526	(15.71	(17.72
095.477	16.90:	–	371.524	(14.46	(15.86
096.504	16.18:	15.86	378.444	15.09	17.72:
097.464	16.18	–	399.481	14.92	16.99

Table 9. (Continued)

JD	*V1504 Cyg* B	*V363 Lyr* B	JD	*V1504 Cyg* B	*V363 Lyr* B
117.535	15.36	15.86	406.471	(15.71	(17.09
118.308	16.18	15.86	407.370	16.18:	(16.88
145.351	14.92	16.32	408.486	14.92	16.32
151.280	14.21	(16.56	409.484	15.71	15.91
152.275	13.88	(16.88	410.488	(16.60	16.32
156.367	14.38	(16.56	411.441	(16.60	16.39
386.484	16.60	(16.56	412.486	(16.60	16.88
387.450	16.90:	(16.88	427.371	(15.71	17.09
387.472	17.60:	(16.32	428.395	16.18	(18.29
390.469	17.60:	15.86	436.457	(16.60	–
392.505	15.25	15.86:	437.435	(16.60	15.86
412.480	14.55	16.32:	439.407	16.60	16.27
413.503	15.61	–	455.365	–	16.99
425.439	15.71:	–	456.350	–	18.29
427.438	(15.47	–	458.380	14.92	17.72
769.433	16.18:	15.86	460.455	–	(17.72
769.469	(16.60	15.86	461.391	–	(17.72
774.427	16.60	–	463.410	(16.60	(17.72
774.460	16.60	(16.56	490.355	(15.47	16.88:
779.420	15.36	(16.56	491.368	(16.60	(17.72
779.454	15.25	(16.56	492.283	(16.60	(17.09
800.480	(16.60	(16.56	493.375	16.18:	(17.09
803.446	15.95	(16.32	497.336	16.60:	18.01:
805.524	(15.71	–	523.307	–	(17.72
807.483	(16.60	(16.32	525.340	–	(16.56
809.505	16.60	16.56:	706.554	16.60:	17.72
810.498	15.25:	–	729.514	16.18	17.72
823.265	16.60	(15.86	762.476	–	15.95
826.533	15.71	–	763.410	14.87	16.51
828.359	(16.60	16.56	782.418	16.39:	(17.09
828.392	(16.18	(16.32	792.447	(16.60	(17.09
834.423	(16.18	(15.86	793.412	–	(17.72
834.459	(15.71	–	809.329	15.25	18.29:
43049.439	17.60:	15.86	813.420	(16.18	16.32
050.325	17.60:	15.86	814.411	–	15.86
063.239	(14.46	–	839.359	–	16.59
064.254	15.71	16.32	848.357	13.96	(17.72
065.262	13.71	16.56	849.355	13.69	(17.09
066.244	13.80	(16.56	850.393	13.88	(17.09
067.250	13.88	–	852.385	14.29	16.23
072.265	14.46	17.09	853.424	14.29	16.27
44290.625	(16.18	(17.09	900.231	(16.60	(17.09
293.590	14.74	16.23	45057.527	14.34	(17.72
2445147.493	(16.60	16.32	2446683.431	(16.60	17.72
170.430	14.46	(17.09	703.275	(16.60	(17.09
172.370	14.42	(16.88	703.322	(16.60	(17.72
193.321	–	(16.32	730.233	(16.60	16.88
198.446	(16.60	(17.72	730.277	(16.60	17.47
201.400	15.03	(17.72	937.494	(16.60	17.72
205.374	(16.60	16.23	941.496	15.25	16.56
227.318	(14.92	–	47013.493	(16.60	15.83:

Table 9. (Continued)

JD	*V1504 Cyg* B	*V363 Lyr* B	JD	*V1504 Cyg* B	*V363 Lyr* B
228.360	(16.60	16.51	019.367	(14.46	(15.53
229.342	–	17.09:	019.385	(14.46	15.86
232.318	(16.60	(17.72	031.448	14.29	(15.86
488.423	14.13	17.72:	041.416	(14.46	(15.86
495.465	15.76	15.91	061.283	(15.71	(16.56
522.452	(16.60	16.32	295.444	(16.18	(16.56
525.404	(16.60	17.72	303.490	(16.60	16.42
532.501	14.55	16.32:	329.478	14.46	18.01
551.407	15.03:	(17.09	361.448	15.27	16.99
557.446	(16.60	(17.72	375.297	15.47:	15.86:
606.294	–	(17.72	378.369	(16.18	(15.86
613.287	(16.18	15.95	385.381	14.46	(18.29
616.305	(16.60	16.96	389.389	16.60:	16.23
642.222	(16.60	16.23	393.394	(16.60	16.96
646.190	(16.60	(17.72	415.366	15.31	16.96
665.183	(16.60	16.34	437.286	(16.60	16.32
673.177	16.60	16.56	479.184	(16.60	16.96
703.181	16.60	16.56	734.468	(16.60	15.83
821.502	15.31	17.72	737.465	(14.46	(15.53
821.537	15.31:	17.72	747.402	14.46	(16.56
823.368	16.18:	(17.09	767.309	(16.18	16.59
823.406	16.60	(17.72	768.284	(16.18	16.27
823.441	(16.18	(17.72	773.311	(16.18	17.07
823.474	16.18:	(18.29	774.300	14.34	17.72
824.378	(14.92	(17.09	776.249	16.60	(17.72
824.413	(16.60	17.72:	777.349	(16.60	17.72
824.449	(16.18	(17.72	778.393	(16.60	17.72
824.483	(16.60	(17.72	779.360	(16.60	18.29
859.362	14.92:	(16.56	796.298	14.21:	(16.56
877.444	15.57	16.46	821.187	(16.60	18.29
912.502	16.00	(17.09	821.225	(16.60	18.29
938.385	(16.18	(16.56	824.184	(16.60	16.18
967.336	16.60	(17.09	824.217	(16.60	15.83
967.366	16.18	18.06	825.252	–	16.14
46265.467	(16.60	18.29	825.287	–	16.23
289.319	(15.71	16.32	826.245	(16.18	16.32
325.324	(16.60	18.29	828.222	14.92	(17.09
346.309	14.92	(17.72	829.219	14.98	(17.72
379.202	(16.60	17.72	830.234	16.26	17.72:
410.200	(16.60	(18.29	833.173	(15.71	16.42
681.381	(16.60	18.01	835.181	(16.18	(17.09
683.384	(16.60	18.29	836.255	(16.60	(18.29
2447943.596	–	(15.86	390.463	–	17.09
48029.487	–	15.86	393.487	–	(16.88
036.485	–	16.56:	400.456	–	16.56:
062.370	–	(16.56	418.466	–	18.29:
071.504	–	(16.56	427.486	–	(15.86
076.504	–	15.86	446.462	–	(17.09
118.446	–	15.86	454.425	–	(16.88
121.392	–	(15.86	514.369	–	16.09
131.375	–	15.83	784.495	–	(15.86

Table 9. (Continued)

JD	*V1504 Cyg* B	*V363 Lyr* B	JD	*V1504 Cyg* B	*V363 Lyr* B
132.377	–	16.44	815.478	–	(15.86
153.297	–	(16.88	837.413	–	(16.56
158.290	–	16.23	863.347	–	16.32:
189.281	–	(17.09	870.347	–	(16.88

Table 10. FY Vul, SW Vul

JD	*FY Vul* B	*SW Vul* B	JD	*FY Vul* B	*SW Vul* B
2437118.399	14.12	16.48	2438968.458	14.91	(16.80
136.492	14.68	(16.80	970.515	14.80	16.79
159.293	14.61	(16.80	972.459	14.70	(16.80
163.358	13.81	(16.80	974.477	14.75	(16.80
164,377	13.68	16.79	977.472	14.66	(16.80
165.409	14.43	16.79	979.491	14.66	16.79
166.367	13.68	16.79	980.489	14.61	(16.80
168.420	14.52	16.79	999.428	14.70	(16.80
175.362	15.00	16.48	39236.538	14.80	(16.80
176.381	14.91	16.48	237.548	14.75	16.79
194.358	14.34	16.79	269.509	14.80	16.79
196.295	14.43	16.79	292.475	15.36	16.02
220.260	14.34	16.33	294.408	14.85	16.02
223.210	14.43	16.33	301.431	14.61	(16.80
546.397	14.43	16.79	323.493	14.70	16.79
576.319	14.34	16.79	329.495	14.66	16.79
578.304	13.68	16.79	334.503	14.75	16.79
843.490	14.52	16.79	344.296	14.43	16.33
876.514	14.34	16.79	346.297	14.57	16.79
877.454	14.38	16.79	379.319	14.91	16.79
885.464	14.85	16.79	382.295	14.70	(16.80
887.473	14.70	16.79	383.450	14.75	(16.80
902.337	14.66	16.79	384.312	14.80	16.79
38144.501	14.66	16.79	385.290	14.61	16.79
227.390	14.70	16.79	385.379	14.70	16.79
261.460	14.52	16.79	387.352	14.66	16.79
268.426	14.70	16.64	387.404	14.80	16.02
281.306	14.34	16.79	391.374	14.52	16.33
282.262	14.80	16.79	408.282	14.70	16.79
554.485	14.70	16.79	646.499	14.75	16.79
561.403	14.57	16.79	647.477	14.85	16.79
623.454	14.70	16.79	652.469	14.85	16.79
668.345	14.91	16.79	655.486	14.57	16.79
669.218	14.80	16.79	677.476	14.80	16.79
673.303	14.80	16.79	678.454	14.80	16.79
673.343	14.91	16.79	681.473	14.75	16.79
697.249	14.91	16.48	684.493	14.68	16.79
698.219	14.75	16.64	686.462	14.38	16.79

Table 10. (Continued)

JD	FY Vul B	SW Vul B	JD	FY Vul B	SW Vul B
699.250	14.85	16.33	689.466	13.68	16.79
703.220	14.61	16.79	704.324	14.85	16.02
880.521	14.70	16.79	706.404	14.75	16.02
886.499	14.52	16.79	707.300	14.70	16.79
905.461	14.91	16.79	707.338	14.75	16.79:
910.402	14.70	16.79	708.343	14.78	16.79:
913.481	14.61	16.79	711.373	14.43	–
916.413	14.43	16.79	712.341	14.43	16.79
942.416	14.52	16.79	714.336	13.75	16.79
946.391	14.80	16.79	716.427	13.68	16.79
951.491	14.70	16.79	730.308	14.57	16.79
964.438	14.85	16.79	743.424	14.75	16.79
2439745.399	14.85	16.79	2440510.284	14.80	16.79
746.411	14.77	16.79	511.252	14.91	16.79
764.349	14.38	16.79	512.310	14.86	16.79
765.260	14.38	16.79	744.484	14.43	16.79
765.306	14.43	16.79	744.507	14.43	16.79
765.357	14.52	16.79	747.506	14.52	16.48
767.258	14.57	16.79	775.457	15.02	16.79
767.304	14.70	16.79	779.366	15.02	16.79
767.351	14.75	16.79	783.474	14.91	16.79
769.249	14.80	16.79	799.500	14.78	16.79
769.294	14.77	16.79	800.513	14.80	16.79
769.339	14.80	16.79	801.413	14.78	16.79
770.233	15.00	16.79	802.452	14.80	16.79
770.277	14.75	16.79	806.419	14.43	16.79
770.323	14.80	16.79	809.536	14.52	16.79
770.368	15.08	16.79	810.373	14.48	16.79
772.288	14.80	16.79	812.535	14.52	16.79
968.530	14.75	16.33	819.266	14.70	16.79
968.554	14.91	16.79	821.365	14.50	16.79
974.542	14.80	16.79	823.432	14.61	16.79
39999.412	14.34	16.79	827.403	14.61	16.79
40007.419	14.91	16.79	828.459	14.43	16.79
033.481	14.18	16.79	41161.537	14.85	16.79
036.452	14.43	–	177.446	14.85	16.02
072.460	15.02	16.79	417.549	14.91	16.79:
086.297	14.70	16.40	427.546	14.85	16.64
093.465	14.80	16.79	452.519	14.91	16.79
094.420	14.75	16.79	454.496	14.91	16.79
096.302	14.80	–	475.468	14.85	16.79
097.500	14.75	16.79	482.507	14.75	16.33
098.358	14.66	16.64	486.478	14.61	16.79
117.429	14.75	16.79	492.538	15.00	16.79
118.273	14.70	16.79	508.353	14.43	16.79
119.266	14.83	16.79	510.483	13.68	16.79
122.291	14.38	16.79	513.484	–	16.79
123.276	14.61	16.79	514.494	14.80	16.64
125.310	14.61	16.79	518.497	14.91	16.79
153.197	15.02	16.79	522.517	14.85	16.79
157.360	14.91	16.79	530.292	14.70	16.64

Table 10. (Continued)

JD	FY Vul B	SW Vul B	JD	FY Vul B	SW Vul B
386.508	14.66	16.79	532.277	14.85	16.02:
387.496	14.75	16.79	536.515	15.08	16.79
426.392	14.78	16.79	546.428	14.52	16.48
427.470	14.85	16.79	548.415	14.52	16.79
428.455	14.91	16.02	564.312	14.85	16.79
473.340	15.02	16.79	565.325	14.91	16.79
475.302	14.97	16.79	566.316	14.70	16.79
475.338	15.02	16.79	567.337	14.80	16.79
502.249	15.14	16.79	568.302	14.52	16.79
502.285	14.91	16.79	569.308	14.52	16.79
509.240	14.80	16.79	570.308	14.43	16.79
2441571.334	14.66	–	2442601.435	14.34	16.79
573.319	14.57	16.79	605.420	14.70	16.79
575.350	14.75:	16.79	607.458	14.75	16.79
576.281	14.91	16.79	625.398	14.91	16.40
577.387	15.04	16.64	626.517	14.75	16.40
594.263	14.61	16.79	630.528	14.80	16.79
595.268	14.66	16.79	637.341	14.43:	16.40
596.258	14.85	16.79	642.482	15.00	16.02
597.286	14.91	16.79	654.268	14.83	16.79
598.295	14.91	16.79	658.388	14.34	16.79
803.532	14.52	16.79	659.335	14.34	(16.80
813.519	14.80	16.48	661.322	14.38	16.79
837.455	14.85	16.79	662.294	14.43	16.79
838.514	14.91	16.79	665.280	15.08	16.79
839.502	14.91	16.64	667.291	14.75	16.79
842.494	14.75	16.79	668.367	14.91	16.79
860.469	15.00	16.79	684.317	14.38	16.40
864.490	14.75	16.79	744.172	14.80	16.79
865.516	14.52	16.79	747.157	14.78	16.79
869.490	14.47	16.79	749.166	14.80	16.79
873.502	14.75	16.79	869.581	14.80	–
875.512	15.31	16.79	930.429	14.91	16.04
887.406	14.80	16.79	960.446	15.02	16.79
892.446	14.47	16.79	961.357	15.14	16.79
901.453	14.80	16.79	965.478	14.85	16.79
902.252	14.85	16.79	43045.364	14.75	16.79
916.376	14.75:	16.79	047.330	14.78	16.79
918.436	14.75	16.79	068.220	14.78:	16.79:
922.444	14.85	16.79	064.228	14.80	16.79
924.412	15.19	16.79	069.254	14.70:	16.79:
928.391	14.80	16.79	072.196	14.40	16.79:
931.448	14.91	16.79	072.231	14.36	16.79
974.311	14.50	16.79	078.184	15.25	16.79
42211.419	14.47	16.79	198.624	15.25	16.79
216.501	14.80:	16.02:	232.538	14.80	16.79
218.493	15.35	16.79	303.440	15.25:	16.40
221.408	14.88	16.79	312.507	14.70	16.79
254.473	14.75	16.79	321.442	14.75	16.48
257.497	14.70	16.79	344.357	14.80:	–

Table 10. (Continued)

JD	FY Vul B	SW Vul B	JD	FY Vul B	SW Vul B
300.365	14.75:	–	347.315	15.00	16.79
507.574	14.80	16.79	350.510	14.80	16.79
539.537	14.66	16.79	365.316	14.80	16.79
542.507	14.70	16.79	369.296	15.14	16.79
546.499	14.83	16.79	389.269	14.80	16.79
551.490	14.75	16.79	390.292	14.75	16.79
567.413	15.02	16.64	393.271	15.14	16.79
577.518	14.75:	–	399.292	14.61	16.79
579.485	14.85	16.02	418.241	14.70	16.79:
597.441	14.78	16.79	423.258	14.70	16.79
599.474	14.78	16.79	430.311	15.14	16.40
2443667.498	14.70	16.79	2444795.454	14.43	16.02
672.399	15.31	16.79	811.445	14.91	16.79
687.443	14.91	16.79	819.399	14.43	16.79
693.426	15.31	16.79	824.506	14.91	16.79
700.416	14.75	16.79	838.382	14.72	16.79
722.400	15.14:	16.79	845.270	14.91	16.02
729.428	13.68:	–	848.299	15.08	(16.80
745.325	15.26	16.79	851.265	14.75	16.79
747.387	15.16	16.79	873.317	14.85	16.79
751.387	15.02	16.17	899.199	14.80	16.79
779.319	15.14	16.79	905.265	14.96	16.79
784.301	14.80	16.79	906.239	14.78	16.79
785.322	14.75	16.79	45057.562	14.85	16.79
800.179	15.36	16.79	116.464	14.88	16.02
815.260	14.75	16.79	144.481	14.25	16.79
866.161	14.52	16.02:	164.390	15.25	16.79
938.609	14.91	16.79	169.466	15.14	16.48
44000.460	15.34	16.79	173.458	14.43	(16.80
020.503	14.80	16.48	192.340	15.31	–
028.500	14.80	16.79	199.401	14.80	16.79
040.394	16.10:	16.79	227.250	14.43	16.79
046.427	14.91	16.79	256.306	15.02	16.79
072.420	15.00	16.79	492.482	14.88	16.79
076.511	14.85	16.79	496.498	14.91	–
104.357	14.91	16.79	504.510	14.34	16.02
111.377	14.78	16.79	522.493	15.02	16.79:
117.430	14.38	16.79	523.468	15.00	16.16
130.336	14.91	16.79	524.392	14.80	16.79
134.310	14.91	16.79	524.412	14.80	16.40
136.379	14.91	16.02	524.430	14.70	16.79
164.203	15.14	16.79	525.435	14.52	16.79
186.259	15.14:	16.40:	526.364	14.27	16.79
194.275	14.80	16.79	526.431	14.36	16.79
399.443	14.80	16.79	526.448	14.43	16.79
408.450	14.85	16.79	526.465	14.36	16.79
413.459	14.27	16.64	526.517	14.43	16.79
433.455	14.27	16.13	528.506	14.43	16.79
442.347	14.91	16.79	535.433	15.25	16.79
457.379	14.78	–	535.455	14.91	16.79

Table 10. (Continued)

JD	FY Vul B	SW Vul B	JD	FY Vul B	SW Vul B
483.326	14.91	(16.80	535.469	14.96	16.79
489.351	14.43	16.79	535.488	15.08	16.79
493.336	14.78	16.79	558.416	14.75	16.40
494.321	14.70	16.79	846.513	14.70	16.02
521.247	14.47	16.79	859.437	14.75	16.79
705.541	14.78	16.79	46707.272	14.80	16.79
759.500	14.91	16.79	937.523	14.91	16.79
763.484	14.91	16.79	943.516	15.00	16.79
764.458	14.85	16.79	971.444	14.91	16.79
765.438	14.80	16.79	973.350	14.96	16.79
785.449	14.85	16.79	973.487	14.80	16.79
2446974.390	14.83	16.79	2447061.313	14.91	16.79
974.465	14.91	16.79	310.508	15.00	16.79
975.351	15.22	16.79	324.508	14.38	16.79
977.493	14.98	16.79	358.513	15.31	16.79
978.491	15.14	16.79	367.472	14.75	16.79
979.434	14.91	16.79	383.506	14.75	16.79
979.491	14.91	16.79	407.332	14.71	16.79
47013.346	14.85:	16.79:	407.401	14.97	(16.80
027.321	14.91	–	681.501	14.92	(16.80
035.394	15.02	16.13	818.226	14.84	16.79
042.436	14.70	16.79	825.187	14.86	16.79
055.348	14.73	16.79	48091.476	14.73	16.79