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Medium-term variability of FY Per

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The light variability of FY Per was discovered by Morgenroth (1936). This star has been classified as a cataclysmic variable (Ritter 1990; Zwitter & Munari 1994) or a Herbig Ae/Be star (Okazaki 1993). Richter (1964) suggested that this star varies irregularly. Short-term variability was discussed by Sazonov & Shugarov (1992), who claimed the detection of the 0.064848 d period, however a more extensive study by Okazaki (1993) could not confirm the evidence of short period variation. Sazonov & Shugarov (1992) reported that the duration of small outbursts is about 20 d, though more details were obscure.

The authors started intensive monitoring and obtained 140 data from 1996 July (JD 2450290) through 1999 August (JD 2451422). The original data are listed in Table 1 and the light curve is shown in Figure 1. The smoothed light curve between JD 2451000 and JD 2451300 which used 2-day means is shown in Figure 2. This light curve demonstrates following characteristics ;

- (1) The observed magnitude range is 11.0-12.2
- (2) Two distinct patterns of variability exist:
 - (a) The star is mainly in the bright state, and short declines with 6-8 d duration are shown; for example JD 2451170 - JD 2451250.
 - (b) The star is mainly in the faint state, and short outbursts are shown (faint state duration is equal to or more than bright state duration); for example JD 2451050 - JD 2451150.
- (3) Short declines and short outbursts mentioned above occurred quasiperiodically with 20-30 d.

These characteristics seem different from the previously known characteristics of cataclysmic variables. Further observations are strongly encouraged to get more detail during the bright state and the faint state.

Acknowledgments

I would like to thank Dr.Taichi Kato (Kyoto University) for helpful suggestions and reading the manuscript..

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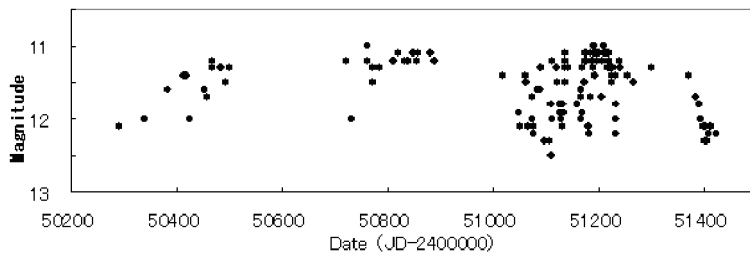


Figure 1: Light curve of FY Per

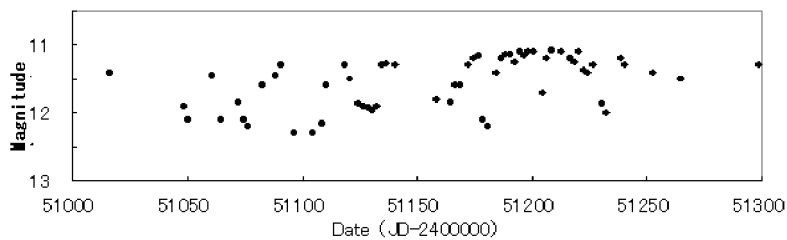


Figure 2: Smoothed light curve which used 2-day means

Eclipse period of FN Sgr

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FN Sgr is a symbiotic star discovered by Ross (1926). Some outbursts were observed in 1924-26 and in 1936-41 (Beliaevsky 1927; Payne 1928; Kenyon

Table 1: Observation data of FY Per

JD-2400000	Mag.	Obser.	JD-2400000	Mag.	Obser.	JD-2400000	Mag.	Obser.
50290.185	12.1	Wnt	51109.205	12.5	Wnt	51196.101	11.1	Wnt
50339.210	12.0	Wnt	51111.194	11.2	Wnt	51197.069	11.2	Wnt
50383.277	11.6	Mhh	51111.236	12.0	Mhh	51199.089	11.1	Wnt
50413.082	11.4	Mhh	51119.127	11.3	Wnt	51201.064	11.1	Wnt
50418.150	11.4	Mhh	51120.994	11.5	Wnt	51205.040	11.7	Mhh
50425.212	12.0	Wnt	51125.096	11.8	Wnt	51206.956	11.2	Wnt
50450.991	11.6	Mhh	51125.240	11.9	Mhh	51208.113	11.1	Wnt
50455.927	11.7	Mhh	51125.969	11.9	Wnt	51208.960	11.0	Wnt
50467.003	11.3	Mhh	51127.131	11.9	Wnt	51209.912	11.1	Wnt
50467.050	11.2	Wnt	51128.131	11.9	Wnt	51213.965	11.1	Wnt
50483.997	11.3	Wnt	51129.124	12.0	Mhh	51216.041	11.1	Wnt
50492.045	11.5	Mhh	51129.216	11.9	Wnt	51216.963	11.3	Wnt
50499.085	11.3	Wnt	51130.078	12.1	Mhh	51218.041	11.2	Wnt
50721.202	11.2	Wnt	51131.220	11.8	Wnt	51219.165	11.3	Wnt
50730.142	12.0	Wnt	51132.994	11.9	Wnt	51220.097	11.1	Wnt
50760.973	11.2	Wnt	51135.178	11.3	Wnt	51222.058	11.3	Wnt
50761.194	11.0	Mhh	51136.162	11.1	Wnt	51222.901	11.3	Wnt
50771.199	11.5	Mhh	51137.106	11.2	Wnt	51223.997	11.5	Mhh
50771.217	11.3	Wnt	51137.169	11.5	Mhh	51224.074	11.4	Wnt
50785.103	11.3	Wnt	51141.015	11.3	Wnt	51225.085	11.4	Wnt
50810.093	11.2	Wnt	51159.165	11.8	Wnt	51227.024	11.3	Wnt
50819.218	11.1	Wnt	51165.103	12.0	Mhh	51230.023	12.0	Mhh
50832.065	11.2	Wnt	51165.135	11.7	Wnt	51230.125	11.4	Wnt
50838.023	11.2	Wnt	51166.162	11.6	Wnt	51230.991	12.2	Mhh
50838.968	11.2	Wnt	51168.078	11.9	Mhh	51232.024	12.0	Wnt
50848.136	11.1	Wnt	51169.153	11.3	Wnt	51233.017	12.2	Mhh
50855.090	11.2	Wnt	51172.167	11.5	Mhh	51233.057	11.8	Wnt
50855.938	11.1	Wnt	51173.117	11.1	Wnt	51238.044	11.2	Wnt
50879.945	11.1	Wnt	51174.007	11.2	Wnt	51241.010	11.3	Wnt
50887.949	11.2	Wnt	51176.269	11.1	Wnt	51253.910	11.4	Mhh
51017.247	11.4	Wnt	51177.053	11.2	Wnt	51265.976	11.5	Wnt
51048.256	11.9	Wnt	51179.094	12.1	Mhh	51298.974	11.3	Wnt
51050.281	12.1	Mhh	51181.112	12.2	Mhh	51369.228	11.4	Wnt
51060.156	11.4	Wnt	51184.094	11.7	Mhh	51384.267	11.7	Wnt
51061.139	11.5	Wnt	51184.176	11.1	Wnt	51390.242	11.8	Wnt
51065.294	12.1	Mhh	51186.141	11.2	Wnt	51393.198	12.0	Wnt
51073.132	12.0	Wnt	51187.028	11.2	Wnt	51398.290	12.1	Wnt
51073.255	11.7	Mhh	51188.008	11.1	Wnt	51399.251	12.3	Wnt
51075.158	12.1	Wnt	51188.099	11.3	Mhh	51400.235	12.3	Wnt
51076.165	12.2	Mhh	51189.073	11.0	Wnt	51401.281	12.1	Mhh
51082.226	11.6	Mhh	51190.017	11.0	Wnt	51402.226	12.3	Wnt
51089.186	11.6	Mhh	51190.158	11.4	Mhh	51405.194	12.3	Wnt
51089.208	11.3	Wnt	51191.042	11.0	Wnt	51408.158	12.2	Wnt
51090.215	11.3	Wnt	51192.192	11.1	Wnt	51411.283	12.1	Wnt
51096.189	12.3	Mhh	51192.990	11.4	Mhh	51412.274	12.1	Wnt
51105.115	12.3	Mhh	51194.065	11.1	Wnt	51422.271	12.2	Wnt
51109.169	11.8	Wnt	51195.156	11.1	Wnt			

The magnitudes were estimated against these GSC stars: GSC3355.646 (V=11.0), GSC3355.883 (V=11.1), GSC3355.741 (V=11.5), GSC3355.699 (V=12.2). Observer code : Mhh (H. Maehara) , Wnt (T. Watanabe) Instrument: 20cm re°ector + visual (H. Maehara), 32cm re°ector + visual (T. Watanabe)

Table 1: Eclipse period of symbiotic stars

star	peirod	References
AX Per	681.6d	Kenyon 1982
CI Cyg	855.25d	Aller 1954
V1329 Cyg	950d	Grygar, et al. 1979
V1413 Aql	434d	Wakuda 1988
FG Ser	658d	Munari et al. 1995

1986). Some of symbiotic stars are known to show deep eclipses during outburst. The period of these stars are listed in Table 1. However, no such obvious declines were observed in FN Sgr. A new outburst has continued since 1995 (Makiguchi 1995). We VSOLJ members obtained 53 observations from 1995 September through 1999 October which are listed in Table 2. Figure 1 shows the overall light curve of FN Sgr. Two declines were detected on JD 24450180 - JD 24450340 and on JD 2451340 - JD 2451440. An another decline seems to have occurred near in 1998 February, around the solar conjunction (VSNET light curve). Therefore, the period of decline of FN Sgr is about 600 d, not about 1200 d. The data were analyzed using the PDMWIN program (Widjajae 1996) which is based on Phase Dispersion Minimization (PDM) method (Stellingwerf 1978). The resultant theta diagram is shown in Figure 2. The best determined period is 571.5 d. The minimum date in 1999 is analyzed using AVE program (Barverae 1996), and JD 2451403.4 is obtained. As a result, we obtained following element: $\text{Min} = \text{JD } 2451403.4 + 571.5d * E$

The phase-folded light curve using the above element is shown in Figure 3. This light curve close resembles those of well-known eclipse light curves of symbiotic stars. Thus, it is almost certain that the detected declines are caused by eclipse. The duration of eclipse is 0.2 by phase (= 120 d), and the duration of totality is 0.1 by phase (= 60 d). Multi-colore analysis of FN Sgr in decline is strongly encouraged.

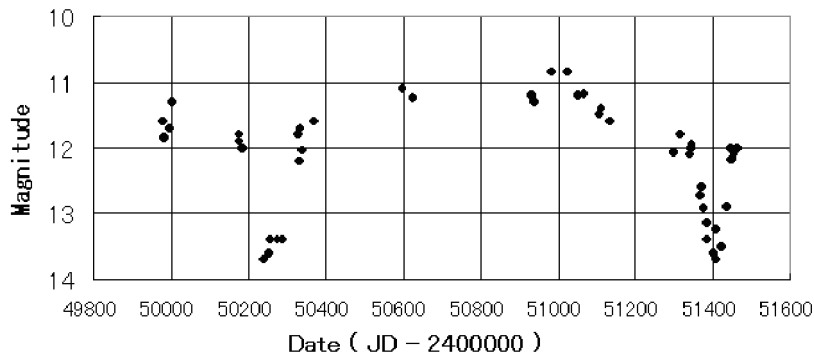


Figure 1: Overall right curve of FN Sgr

Acknowledgements

This work has been based on VSOLJ Database. We wish to thank the following observers for them valuable observation; M.Moriyama, K.Hirosawa and H.Maehara. We wish to express our sincere gratitude to Dr. Taich Kato, Kyoto University, who kindly read the manuscript and suggested many improvements.

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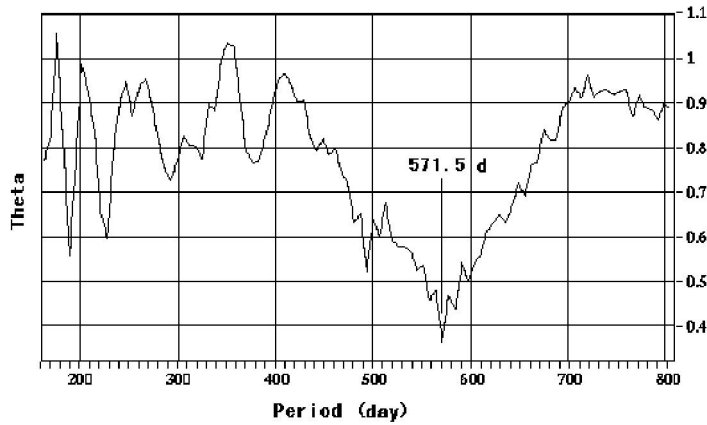


Figure 2: Theta diagram by PDM analysis

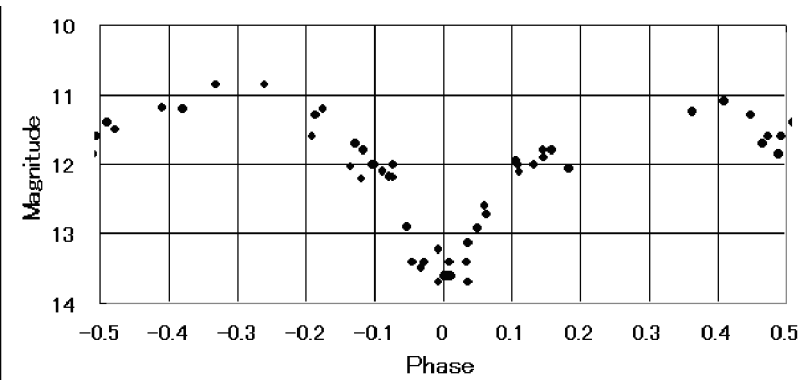


Figure 3: Phase-folded light curve

Table 2: Magnitude estimates of FN Sgr

JD-2400000	Mag.	Obser.	JD-2400000	Mag.	Obser.	JD-2400000	Mag.	Obser.
49977.944	11.6	Hsk	50369.986	11.6	Wnt	51369.097	12.58V	Kis
49979.075	11.6	Myy	50597.188	11.1	Kis	51369.157	12.6	Wnt
49980.972	11.85V	Kis	50624.086	11.25V	Kis	51375.128	12.92V	Kis
49993.939	11.7	Hsk	50932.262	11.2	Wnt	51383.075	13.14V	Kis
50003.967	11.3	Has	50938.219	11.3	Wnt	51384.118	13.4	Wnt
50176.310	11.9	Has	50981.111	10.85V	Kis	51398.983	13.6	Wnt
50177.285	11.8	Has	51022.111	10.85V	Kis	51402.115	13.6	Wnt
50177.285	11.9	Has	51049.046	11.2	Wnt	51408.080	13.23V	Kis
50185.236	12.0	Has	51066.069	11.18V	Kis	51408.131	13.7	Wnt
50240.155	13.7	Has	51104.935	11.5	Wnt	51421.973	13.5	Wnt
50254.069	13.6	Kis	51111.915	11.4	Wnt	51433.962	12.9	Wnt
50255.103	13.4	Has	51132.887	11.6	Wnt	51444.990	12.0	Mhh
50276.134	13.4	Kis	51298.263	12.07V	Kis	51444.992	12.19V	Kis
50286.106	13.4	Wnt	51313.199	11.8	Wnt	51448.986	12.17V	Kis
50326.996	11.8	Wnt	51340.080	12.11V	Kis	51453.938	12.1	Wnt
50329.103	12.2	Myy	51341.200	12.0	Wnt	51460.952	12.0	Wnt
50334.024	11.7	Wnt	51343.160	11.95V	Kis	51462.907	12.0	Wnt
50338.000	12.04V	Kis	51367.234	12.72V	Kis			

Observer code : Has (N.Hasegawa), Hsk (K.Hirosawa), Kis (S.Kiyota), Mhh (H.Maehara), Myy (M.Moriyama), Wnt (T.Watanabe) Magnitude: V:Johnson V, others:visual

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Period revision of ES Del

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ES Del (R.A. 20h 43m 58s.41 Dec. +19° 14' 17".4 (J2000)) is a Mira type variable, whose period was proposed as 373.9 d (Huth 1956; 1957). However, the contradiction between this period and the latter observed maximum dates (Halle 1974) was pointed out (Kholopov 1986). We obtained 157 visual observations from 1990 (JD 2448100) through 1999 (JD 24514700) and we observed 7 maxima. The light curve is shown in Figure 1. As a result of analysis, 509.6 d period was obtained. The best element which satisfying the observed maximum dates is follows:

$$\text{Max} = \text{JD } 2450290 + 509.6 \text{ d} \times E$$

The observed maximum dates and O-C data calculated using the above new element are listed in Table 1. The maximum date in 1990 and in 1995 were obtained by fitting their light curves to the light curve in 1996 which closely resembles them. Seeing the O-C values in Table 1, the period of ES Del is surely 509.6 d now, not 373.9 d. The contradiction between this 509.6 d period and the former 373.9 d period can be explained by the period change. I will report on this subject separately (Watanabe 2000).

Acknowledgments This work is based on the VSOLJ database. We wish to thank Hiroyuki Maehara, Minoru Satoh, Masayuki Moriyama, and Kenji Hirosawa for their valuable observations. I would like to thank Dr. Taichi Kato (Kyoto University) for helpful suggestions and reading the manuscript.

Table 1 : Maximum dates and O-C data

observed maximum UT	E JD	O _i	C
1990 December 26	2448252	-4	0
1995 March 1	2449778	-1	-2
1996 July 27	2450292	0	2
1997 December 15	2450798	1	-2
1999 May 11	2451310	2	1

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 Watanabe T., 2000, in preparation

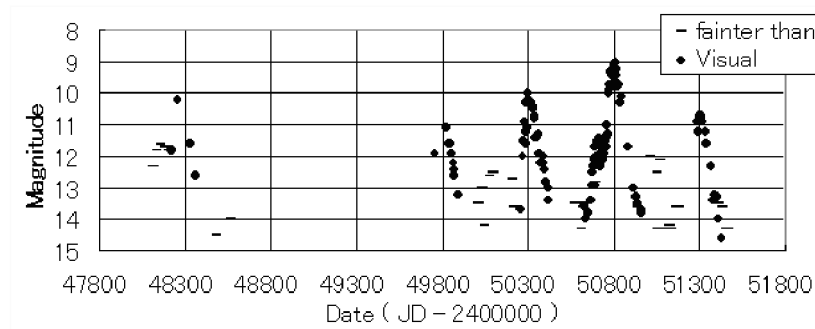


Figure 1: Light curve of ES Del from 1990 through 1999
 Observer: T.Watanabe (61 obs.), M.Hiraga (45 obs.), H.Itoh (35 obs.),
 H.Maehara (8 obs.), M.Satoh (4 obs.), M.Moriyama (3 obs.) and
 K.Hirosawa (1 obs.)

Detection of the second historical standstill of HL CMa

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HL CMa, discovered as the optical counterpart of the hard X-ray source 1E 0643.0-1648 (Chlebowski et al. 1981), is a cataclysmic variable with a mean outburst cycle around 15 days (Meinunger 1981). This star had been classified as a U Gem-type dwarf nova (Patterson 1984). However, with HL CMa's short recurrence time and 5 hr orbital period, the possibility that HL CMa may belong to the Z Cam type of dwarf novae has been suggested (Cannizzo et al. 1988). The first obvious standstill which continued for about 40 days, was observed in 1982 (cf. Mauche 1987; Kato 1996).

Our observations have detected the second historical standstill beginning in August 1999 (JD 2451420). The light curve from January 1999 through January 2000 (JD 2451180 - 2451560), which contains observations from the VSOLJ Database, is shown in Figure 1. This standstill has already continued for 140 days, showing a longer standstill than the one observed in 1982.

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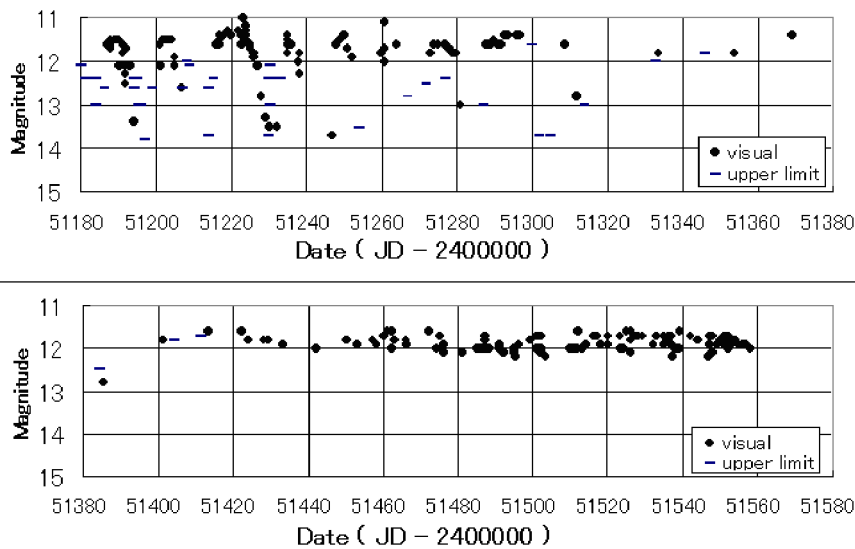


Figure 1: Figure 1 : Light curve of HL CMa
 Observer's Observations: R. Stubbings (102 obs.), T. Watanabe (60 obs.),
 H. Maehara (38 obs.), H. Itoh (16 obs.), S. Takahashi (6 obs.), M. Hiraga (6 obs.),
 Y. Watanabe (1 obs.) and T. Nishimura (1 obs.)

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