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NEW TIMES OF LIGHT MAXIMA FOR CY Aqr

CY Aqr is an SX Phe type variable whose magnitude in V band varies from $10^{m}_{.}42$ to $11^{m}_{.}16$. Its spectral type varies from A2 to A8. The star was one of the most extensively observed SX Phe type stars which had detectable period variations in the last sixty years. There are many different interpretations for its variations (Kamper, 1985, etc.). In order to know the real situation, we observed it on September 28, 1984 and got a new moment of light maximum. After that during October 19 to 22, 1993 we observed the star again and obtained eight new times of light maxima. The data showed an obvious systematic delay with respect to the times calculated from the formula given by Pena et al. (1987). To check the reliability of the differences we performed new observations on December 7, 1993 which showed that these new times of light maxima were reliable. The ten new times of light maxima for CY Aqr are as follows:

No	T_{max} (HJD 2400000.0+)
1	45972.1828
2	49280.0396
3	49281.0776
4	49281.1390
5	49282.0540
6	49282.1150
7	49282.1760
8	49283.0313
9	49283.0915
10	49328.9938

At first we used the times of light maxima got before 1993 including those published in the literature (Zissel, 1991; Rodriguez et al., 1990, etc.) and the first new time listed above to obtain a linear fit in the form of:

$$T_{max}=T_{01}+P_{01}\times E \qquad (1)$$

and a quadratic fit as:

$$T_{max}=T_{02}+P_{02}\times E+0.5\beta\times E^2 \qquad (2)$$

We got T_{01}, P_{01}, T_{02}, P_{02} and β of the variable star as below:

star	T_{01}(HJD)	P_{01}(days)	T_{02}(HJD)	P_{02}(days)	β(day/cycle)
CY Aqr	2434308.4299	0.061038330	2434308.4280	0.061038410	-3.72×10^{-13}
	±2	±1	±1	±1	$\pm6.5\times10^{-15}$

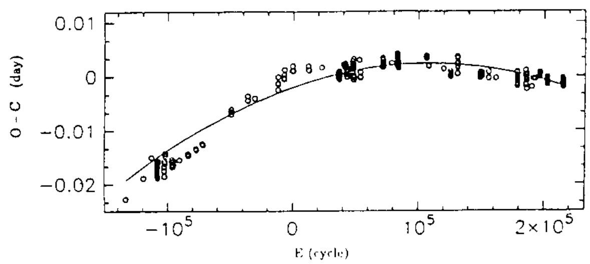

Figure 1. The O−C diagram of CY Aqr derived from the linear ephemeris (1) with the data before 1993.

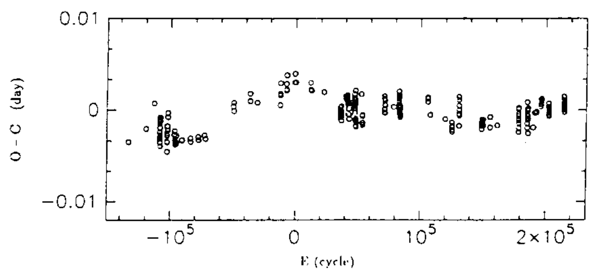

Figure 2. The O−C diagram of CY Aqr derived from the quadratic ephemeris (2) with the data before 1993.

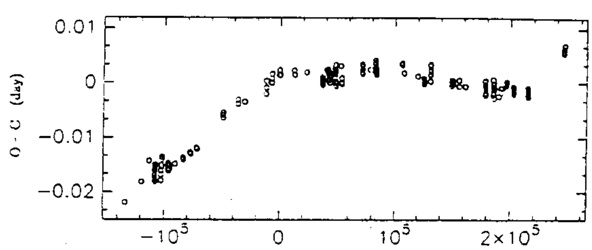

Figure 3. The O−C diagram of CY Aqr derived from the linear ephemeris (1) with the whole data.

Figure 1 shows the O−C diagram obtained by using Eq. (1). Figure 2 shows the O−C diagram as obtained from the quadratic fit. The negative rate of period change, β, means that the period of light variations was decreasing. From Figure 2 we can suspect roughly a quasi-periodic variation.

Then our all new times of light maxima were combined with the old ones to get a whole data set. The results of the linear fit are

T_0=2434308.4296±0.0002,

P_0=0.061038333±0.000000001 days. Figure 3 shows the O−C diagram using linear fit with the whole data. From Figure 3 we can find a new variation.

There are two possible interpretations for the new variation. One of them is a light-time effect caused by the orbital motion of CY Aqr around the mass center of a binary system with an unseen companion. The orbital period would be about 50 years. The other explanation that the rate of period change had a jump from a negative value to a positive value. If we cut the whole data at about 1970 ($E\sim10^5$) to obtain two parts, their rates of period changes would be about -5.4×10^{-13} day/cycle for the first part and 1.05×10^{-12} day/cycle for the second part according to the fits with parabolic curves. Because our new times of light maxima cover rather short time span, any kind of further fit cannot provide more reliable information about the real period variation. More regular observations are needed to check which one is real.

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References:

Kamper, B. C., 1985, *IBVS*, No. 2802
Pena, J. H. et al., 1987, *Rev. Mexicana Astron. Astrof.*, **14**, 429
Rodriguez, E. et al., 1990, *IBVS*, No. 3428
Zissell, R. E., 1991, *J. Am. Assoc. Variable Star Obs.*, **20**, No. 2, 251