LIGHT VARIATION OF LX PERSEI BETWEEN ECLIPSES

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Abstract. Two-colour photoelectric observations of LX Per carried out at Ege University Observatory in 1981 and 1982 observing seasons are presented. The light curve of the system has a wave-like distortion which migrates towards the decreasing orbital phase. The period of the retrograde migration of the wave-like distortion has been determined as 475 days. The amplitude of the wave appears to change with time periodically.

1. Introduction

The eclipsing nature of the fairly bright binary system LX Per was discovered by Strohmeier and Knigge (1960). A deep primary eclipse with an amount of 1.1 mag was observed photographically by Strohmeier et al. (1962), but no secondary eclipse was detected. Later, the system has been observed spectroscopically by Popper (1970) and it was included in the list of binaries known to have H and K emission of ionized calcium in one or both components. Weiler (1974) has also observed the system spectroscopically and classified the components as G0V and K0IV. His study also revealed that the cooler component had strong Ca II emission and was slightly more massive than the hotter component. He also noted that LX Per should be considered as a strong candidate for the group of eclipsing binaries called RS CVn stars. The first photoelectric photometry of the binary obtained by Percy (1976) on two nights indicated the existence of the secondary eclipse with a depth of about 0.17 mag in both B and V colours. Photoelectric spectrophotometry of the H and K of Ca II and Hα emission lines in six RS CVn-type binaries including the LX Per, was made extensively by Weiler (1978) and it was concluded that it exhibits the largest variation in its H and K emissions among the program stars. On the other hand no significant variation has been detected in its Hα emission. A worthy result pointed out by Weiler was the existence of a large, short-term variation in the H and K emission level. The first photoelectric light curves of the system LX Per were published by Tümer et al. (1983). Since the complete light curves could not have been obtained within the observing period between 1979 and 1980, therefore, the shape of the light curve was roughly derived. The wave-like distortion within the light curve were determined and migration period estimated to be 460 days.

In this paper, the observations obtained in 1981 and 1982 are presented and the preliminary results are discussed.

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2. Observations

The observations were achieved with the 48-cm Cassegrain telescope of the Ege University Observatory. An unrefrigerated EMI 9781 A photomultiplier and, $B$ and $V$ filters were used. The stars BD $+ 47^\circ 776$ and BD $+ 47^\circ 784$ were taken as comparison and check stars, respectively. The observations were obtained from 23 September to 24 November in 1981, and from 19 October to 8 December in 1982. The differential magnitudes, in the sense comparison minus variable, were corrected for the atmospheric extinction and the observing times were reduced to the Sun's center. The differential observations obtained in successive two years are given in Table I. The following light elements were used for the calculation of the phases,

$$\text{Min I} = \text{J.D. (hel.)} 2443929.4300 + 8^d038.044 E.$$

3. The Light Variation Outside Eclipses

During the observation in 1979 and 1980 it was discovered by Tümer et al. (1983) that the wave-like distortion at outside eclipses shifted strongly towards the decreasing phase. In Figures 1 and 2 the differential magnitudes obtained in short time intervals were plotted versus orbital phase. The observations were represented with the truncated Fourier series in the form,

$$I = A_0 + \sum_{m=1}^{n} A_m \cos m\theta + \sum_{m=1}^{n} B_m \sin m\theta,$$

where $n$ was taken 2 and 3. It was found that the better representation of the observations could be obtained with the second-order approximation rather than the third order. In Table II, the normalized coefficients for $n = 2$ are given with their standard deviations both for $B$ and $V$ colours.

The continuous lines in Figures 1 and 2 represent the computed curves using the Fourier coefficients for $n = 2$. It may clearly be seen that the computed curves pass through the observations and the representation is satisfactorily. The observations obtained at the end of September and at the second half of November 1981 exhibit how the shape and amplitude of the wave has been changing. The amplitude of the wave decreased and the maximum is shifted from phase 0.9 to around phase 0.7, whereas the shift of the minimum is about 0.05 phase. At the end of October 1982 the wave minimum is around phase 0.63, while it was around phase 0.37 at the end of September 1981.

Examining all the observations obtained by the authors so far the phases of minima in the outside eclipse of the light curve of LX Per and the amplitudes of the distortion were derived and are given in Table III. The first column in this table indicates the time as Julian date. This corresponds to middle of the time interval in which the observations have been obtained. The second and third columns give the phases of minima and amplitudes of the wave.