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ATMOSPHERIC ECLIPSE OF δ SGE

The long period (P=3720 days) bright spectroscopic binary δ Sge exhibits complex spectroscopic phenomena shortly before and after the conjunction times (McLaughlin et al. 1952; Batten and Fisher, 1981). Such phenomena were thought to be due to an atmospheric eclipse in the system during the conjunction times. Based on the timing of such phenomena and the period of the system the last conjunction must have occurred around the beginning of May 1990. However, the improved parameters of the system by Reimers and Schröder (1983) suggest no eclipse during the conjunction times. Because the longitude of periastron is very close to 270°, conjunctions are expected to be very near to periastron passage. The last periastron passage was expected to be in the second week of April 1990.

It is possible that the B9 V component may be eclipsed by the extended atmosphere of the M2 II component at conjunction. If so, then any eclipse (total or partial) in the system could be detected photometrically in short wavelengths, because the contribution of the early-type component to the total light from the system is only a few percent, but it increases towards shorter wavelengths.

We have observed the system with UBV filters on 21 nights in 1988, and 85 nights in 1989. The differential observations with respect to the comparison star β Sge were made by using an EMI 9789 QB photomultiplier attached to the 30 cm Maksutov telescope of Ankara University Observatory. The differential brightness measurements of β Sge with respect to the check star α Sge were found to be sensibly constant during the observations : $\Delta V=-0.00\pm0.01$, $\Delta B=-0.27\pm0.02$, and $\Delta U=-0.73\pm0.04$. The individual differential magnitude determinations were corrected for differential atmospheric extinction, and light time effect. The 1988 observations were already reported (Derman, et al., 1989). The 1989 observations in the sense variable minus comparison are plotted in Figure 1 against the heliocentric Julian date.

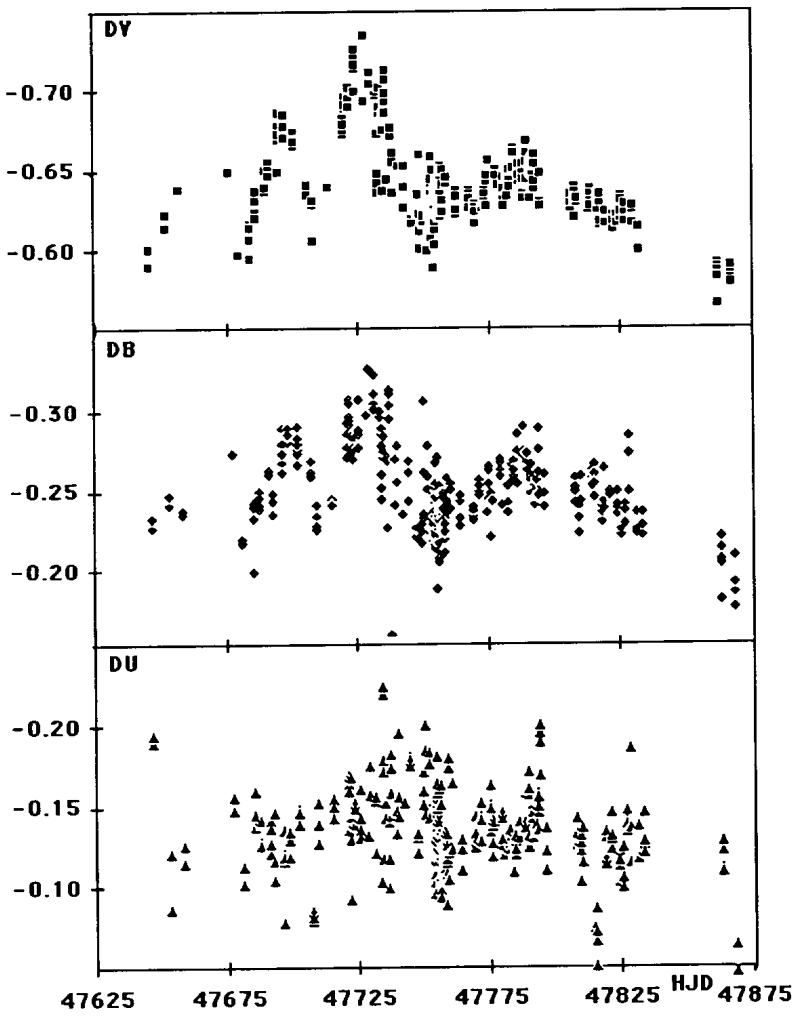

Figure 1. The differential U, B and V observations of δ Sge against heliocentric Julian date (HJD +2400000) in 1989

New observations in Figure 1 verify the periodic nature of the light variation. The amplitude of the variation seems to decrease first until May 1989 and then increases until the end of July 1989, while the period decreases steadily from about 60 days to 28 days. Three cycles of the light variation are clearly seen in V and B observations in Figure 1. The U observations show almost no sign of periodic variation. Thus, the periodic variations should be related to the late type giant component, because this component has large contribution in V and B but less in U magnitudes. Three cycles observed between May and August 1989 have decreasing periods of about 37, 30 and 28 days, respectively. Total mean light from the system increases steadily from May to August 1989, then drops sharply to a lower level, indicating the beginning of an atmospheric eclipse. Contrary to the expectation such behavior of the light variation is better observed in longer wavelengths (see V and B light curves in Figure 1). If the loss of light starting from August 1989 is due to an atmospheric eclipse then the eclipse duration may be as large as 18 months, because the eclipse begins about nine months before the estimated conjunction time. In this case the inclination of the orbit or the size of the giant component ought to be much larger than the predicted values. Otherwise the period of the system may be shorter than 3720 days as suggested by Batten (1989). Figure 1 suggests that the hotter component is eclipsed from the beginning of August 1989 by the extended atmosphere of the cool giant component. The periodic oscillations of the total light fade but do not disappear completely during the eclipse phases. Further observations may reveal the duration of eclipse phenomena which will bring important constraints on the system parameters.

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