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TIME OF MINIMUM DETERMINATION OF THE ECLIPSING BINARY V1143 CYGNI

V1143 Cygni is a bright (Vmax = +5.86) eclipsing binary consisting of a pair of F5V stars moving in an eccentric orbit (e=0.54) with an orbital period of 7.64 days. The orbital and stellar properties of this system have been accurately determined by Andersen et al. (1987) who find that the stars are close to the ZAMS with an age of about 2 x 10^9 years. In addition, independent, recent determinations of the apsidal motion of V1143 Cyg have been made by Khaliullin (1983) and by Gimenez and Margrave (1985). The results of these studies yield an average value for the observed apsidal motion of $\dot{\omega}$obs=3.45$\pm$ 0.14 deg/100 yr. This is somewhat smaller than the result of the combined theoretical classical and relativistic contributions to apsidal motion of $\dot{\omega}$cl+gr= 4.25 $\pm$ 0.72 deg/100 yr. determined by Andersen et al. As first noted by Koch (1977), V1143 Cyg could be an important system for studying general relativity because the relativistic contribution to apsidal motion ($\dot{\omega}$gr = 1.86 deg/100 yr) is nearly equal to the Newtonian contribution ($\dot{\omega}$cl = 2.39 deg/100 yr). The classical or Newtonian contribution to apsidal motion arises from the deviations of the figures of the stars from spherical symmetry, caused by tidal and rotational effects which depend on the fractional radii, masses, rotation rates, and the internal mass distribution of the stars.

Photoelectric photometry of V1143 Cyg was conducted with the 51 cm telescope of Biruni Observatory at Shiraz University, Shiraz, Iran. The observations were made on 10 June 1977 UT using blue (b) and yellow (y) filters which are matched closely to the Strömgren uvby system. The data were reduced using the software developed at Villanova University. Details of the instrumentation and data reduction are given by Guinan et al. (1979). Differential magnitudes were computed in the sense variable minus comparison star in which HD 186239 (V= +7.4; A5V) served as the comparison star. Extinction corrections were applied from the atmospheric extinction coefficients determined from the observations of the comparison star, and the local standard times were converted to heliocentric Julian data (HJD).

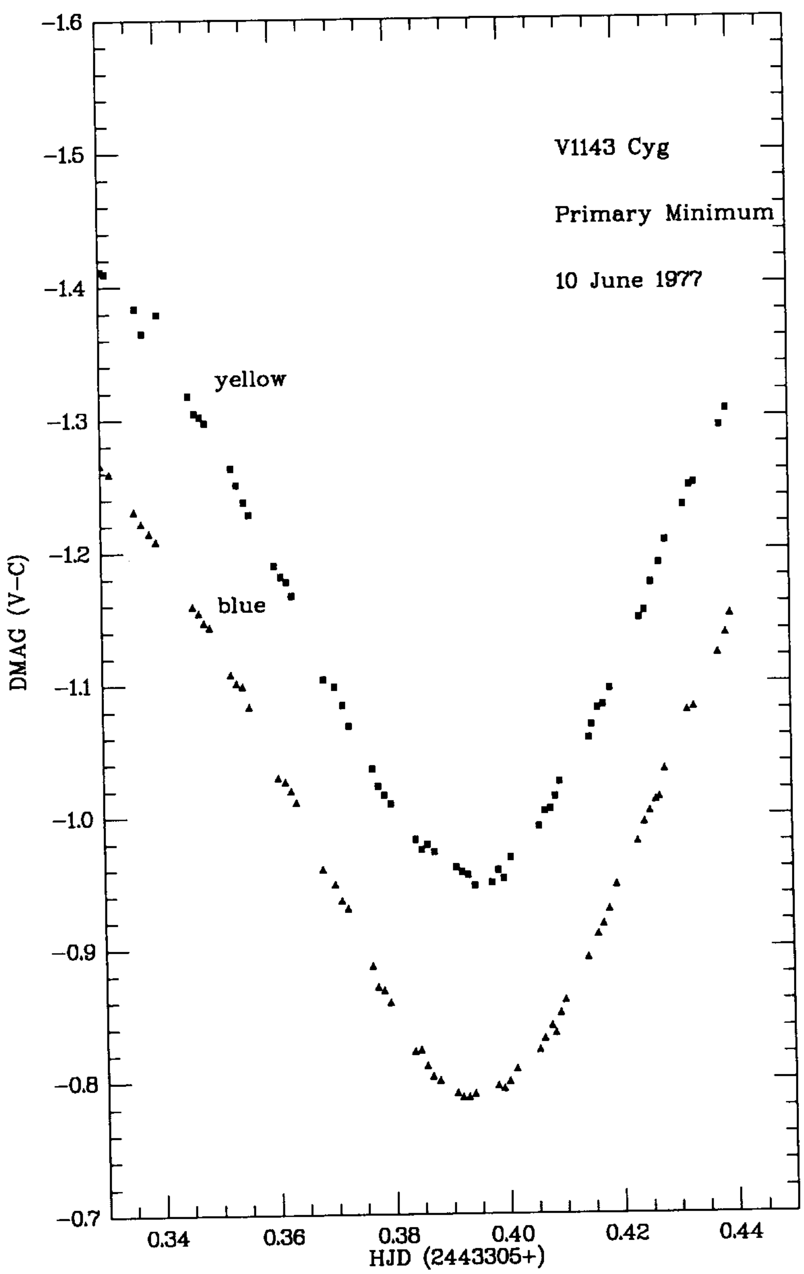

Figure 1 : The differential Strömgren yellow (y) and blue (b) observations of primary eclipse of V1143 Cyg.

The blue and yellow light observations of primary eclipse appear in Figure 1, plotted versus heliocentric Julian Date. A determination of the time of mid-eclipse was made for both light curves using a computer code developed by one of us (SMC). The algorithm involves a computer graphics version of the familiar "tracing-paper" method. The reduced photometric data is first plotted on the screen as observed. This data is then plotted again, reversed in the time coordinate. This second plot can be moved, as a unit, relative to the first curve. When the second plot is positioned such that the curves appear superimposed, the minimum occurs at the same point on the normal and reversed graphs. This best fit method gives extremely precise determinations, as can be seen by the errors given. The time of primary eclipse is:

$$T(\min I) = \mathrm{HJD}\ 2443305.3943 \pm 0.0004.$$

Using the ephemeris of Andersen et al., the (O-C) of this determination is +0.00003d. More photoelectric timings of primary and secondary eclipses of V1143 Cyg are currently being attempted. A further refinement of the system's apsidal motion should be possible with these new timings.

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