COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 3151

Konkoly Observatory
Budapest
26 February 1988
HU ISSN 0374-0676

THE ELLIPSOIDAL VARIABILITY OF 75 PEGASI

75 Pegasi = HD222133 = HR8963 is a single-lined spectroscopic binary with the very short period of 0.5021035 day, and an extreme value of mass ratio (Hube and Gulliver, 1985). Analysis of the spectroscopic data led to the conclusion that the primary component fills, or is close to filling, its critical Roche lobe. Furthermore, it was predicted that a shallow primary eclipse ($\sim 0^m.02$) would occur. After the fact, it is clear that we ought to have made explicitly a prediction of ellipsoidal photometric variations.

75 Pegasi has been observed since September 1987 with the 2-star photometer on the 0.5m telescope of the Devon Astronomical Observatory. Standard B and V filters have been employed. On all but the first night, the comparison star in channel-2 has been SAO108725 and the check star was BD+17°4953. The latter two stars have been constant relative to one another to better than about $0^m.03$. Corrections for atmospheric extinction are negligible with our observing procedures. Corrections for gain variations between the two channels have been made. We have not made transformations from the local to the standard UBV system.

On September 23/24, 1987, a complete sinusoidal light variation was detected during 7 hours of continuous observing, and with phasing relative to the spectroscopic orbit consistent with ellipsoidal variability. Observations on subsequent nights have confirmed the photometric variability and the initial interpretation of it. In this note we present a sample of the available photometric data and results of a very preliminary analysis.

In Figure 1 we have plotted the magnitude differences B(VAR) - B(COMP) obtained on five nights and averaged in phase intervals of 0.025P. Phases are from T_o = HJD2442644.131 as found in the spectroscopic orbital solution. The photometric data are consistent with the spectroscopic period of 0.5021035 day.

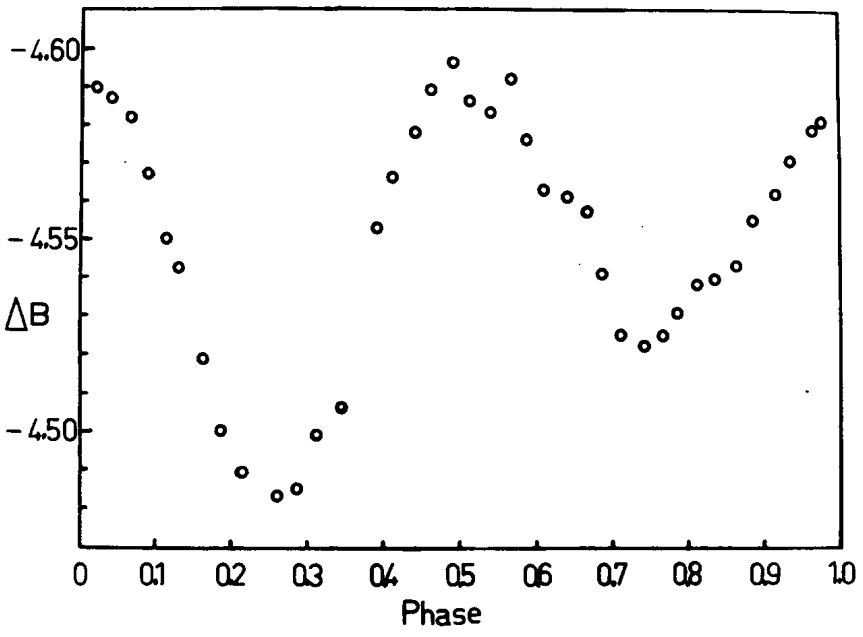

Figure 1

There is some evidence - not revealed in Figure 1 because we have averaged together data from several nights - for cycle-to-cycle variations in the shape of the light curve. These might be due to irregular mass flow from the Roche-lobe-filling primary, or to some intrinsic instability in one of the components. At this time, we cannot exclude observational or reduction errors.

Within the observational uncertainties, the two maxima are equal. The deeper minimum at primary conjunction may include contribution from the predicted shallow eclipse, but that will not be known with certainty until a detailed analysis has been completed. We have used a least-squares routine to fit the following Fourier series to the data in Figure 1

$$\Delta B = \underset{(\pm 0.001)}{-4.549} + \underset{(\pm 0.0018)}{0.0029\cos\theta} - \underset{(\pm 0.0019)}{0.0431\cos 2\theta} + \underset{(\pm 0.0019)}{0.0162\sin\theta} - \underset{(\pm 0.0018)}{0.0043\sin 2\theta}$$

where the uncertainties are standard deviations. The predominance of the cos2θ term is consistent with a gravitationally distorted primary component and ellipsoidal light variation.

A complete discussion of this binary system will be presented elsewhere after the photometric data have been transformed to the standard UBV system and analysed in conjunction with the spectroscopic data.

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Reference:

Hube, D.P. and Gulliver, A.F., 1985, Publ. Astron. Soc. Pacific 97, 280.