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LARGE AMPLITUDE SPOT VARIATIONS ON II Peg

II Peg (= HD224085 = SAO091578) is a member of the RS CVn class of binaries (spotted late-type giants and subgiants). Its optical light curve exhibits a wave of variable amplitude and phase with an underlying period of about 6.72 days. It is a single-line spectroscopic binary, the companion to which has not been hitherto detected. This latter fact makes it a relatively simple system to analyse since one does not have the complication of two spotted stars as in many other systems.

One of the many difficulies in trying to model the spot distributions in RS CVn's is the question of what are their unspotted magnitudes. The maximum of II Peg's light curve (the time when the visible hemisphere is least spotted) has been observed to vary over the last decade between V = 7.34 in 1976 (Rucinski 1977) and V = 7.49 in 1980 (Poe and Eaton 1980). Earlier observations by Chugainov (1976) indicated a light curve maximum of V = 7.18 in 1974. This value for the unspotted magnitude is in conflict with the results of an archival plate survey carried out by Hartmann, Londono and Phillips (1978) which indicated that II Peg was constant (and therefore presumably unspotted) between 1900 and 1940 at a magnitude no brighter than V = 7.3. Chugainov does not identify his local comparison stars and so it is impossible to determine from his published results whether a zero-point error occurred. It seems probable therefore, on the basis of the evidence to hand, that II Peg has never been observed to

have a light curve maximum much brighter than V = 7.3. The largest amplitude variations of II Peg yet observed are those reported by Chugainov (1976) and Vogt (1981) *viz.* V = 0.33.

The purpose of this Bulletin is to draw attention to the fact that, during September 1986, II Peg had a larger amplitude than any reported previously and a brighter maximum

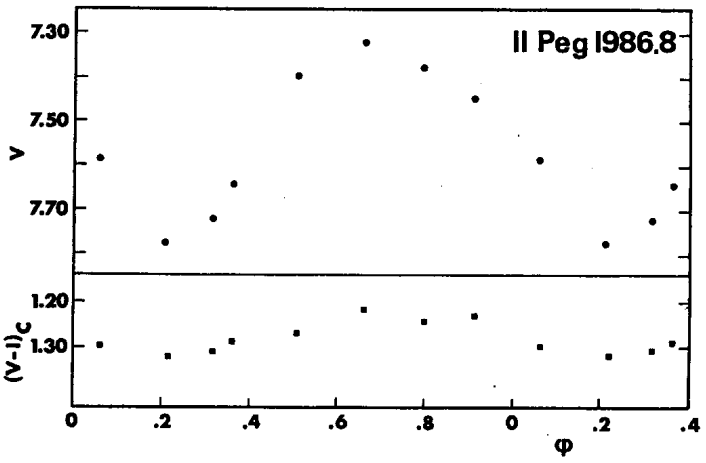

Figure 1

than any previously reported with the exception of the Chugainov data. II Peg was observed with the St. Andrews Photometer on the 1m telescope at the South African Astronomical Observatory's station at Sutherland over a 2-week interval from 9th to 22nd September 1986. Magnitudes were determined on the $UBV(RI)_C$ system by reference to Cousin's E-region standard stars (Menzies, Banfield and Lang 1980) and differentially with respect to a local comparison star C1 = DM+28^{O}4667 (Byrne et al 1983). The mean magnitude and colours derived for C1 were V = 8.245+0.005, (B-V) = +1.281+0.002, (U-B) = +1.356+0.020, $(V-R)_C$ = +0.659+0.006, $(V-I)_C$ = +1.249+0.006. Figure 1 gives a plot of the V and $(V-I)_C$ light curves for II Peg

differenced with respect to C1 and phased according to the ephemeris of Rucinsky (1977) i.e. JD = 2443033.10 + 6.724183 E.

The following points should be noted from the light curve. First, as remarked above, the amplitudes in both V magnitude and $(V-I)_C$ colour are probably the largest yet observed *viz.* V = 0.45 and $(V-I)_C$ = 0.10. Second, the mean magnitude (V = 7.55) is not very different from that observed in the interval 1977-84 (Poe and Eaton 1985, Rodono' et al 1986 and Arevalo, Lazaro and Fuensalida 1985). Third, the mean $(V-I)_C$ is redder than observed previously *viz.* +1.27. Lastly, V_{max} and V_{min} are respectively brighter and fainter than previously observed, except for the observations of Chugainov (1976).

From the first and fourth points above it can be concluded that the degree of asymmetry in the spot distribution and, as a result, the temperature contrast between the two hemispheres of II Peg, is greater than ever observed previously. Yet from the second point the overall degree of spottedness is not markedly greater than it has been in recent years. It seems quite possible therefore that the two major spot activity groups discussed by other authors have moved close to the same stellar longitude, perhaps as a result of differential rotation. This interpretation means that the current light maximum of II Peg may correspond to a surface as free of spots as it has been possible to observe during the last decade. Furthermore the large amplitude of the variation in both magnitude and colour yields a hitherto unique opportunity to determine the size and temperature of the spots photometrically. Similarly spectroscopic observations taken at opposite phases of the variation should enable spectra to be obtained which are representative of the (relatively) spot-free and almost-fully-spotted surfaces of the star respectively.

In view of this unusual configuration and its probable temporary nature I would therefore appeal to optical and IR photometrists and spectroscopists to observe the star on as many nights as possible during the rest of the current season in order to determine its main characteristics. It will also be of the very greatest interest to track the evolution of this unusual state. For instance, will the proposed two major spot groups be seen to separate on the optical light curve and, if so at what rate?

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