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PHOTOMETRIC OBSERVATIONS OF THE AM HERCULIS SYSTEM MR SERPENTIS = PG1550+ 191

MR Ser was discovered to be a system of AM Herculis type in 1981 (Stockman et al., 1981). The defining characteristic of all stars of this sub-class of cataclysmic variables is the exhibition of strong linear and circular polarisation that is variable with the same periodicity as the optical and infrared light as well as the radial velocity. A review of the observed properties of these systems is given in la Dous (1989). Photometric, polarimetric, and spectroscopic observations of MR Ser are presented in Liebert et al. (1982), Echevarria et al. (1982) have discussed infrared spectroscopy of this object, and Szkody et al. (1985) have published IUE observations. Usually MR Ser is found to vary photometrically between 14.^{m}8 and 16.^{m}2 in V, the amplitude of the orbital variation is approximately 1^m . The period of variability is 0.078873 ± 10^{-6} days, as derived by Liebert et al.

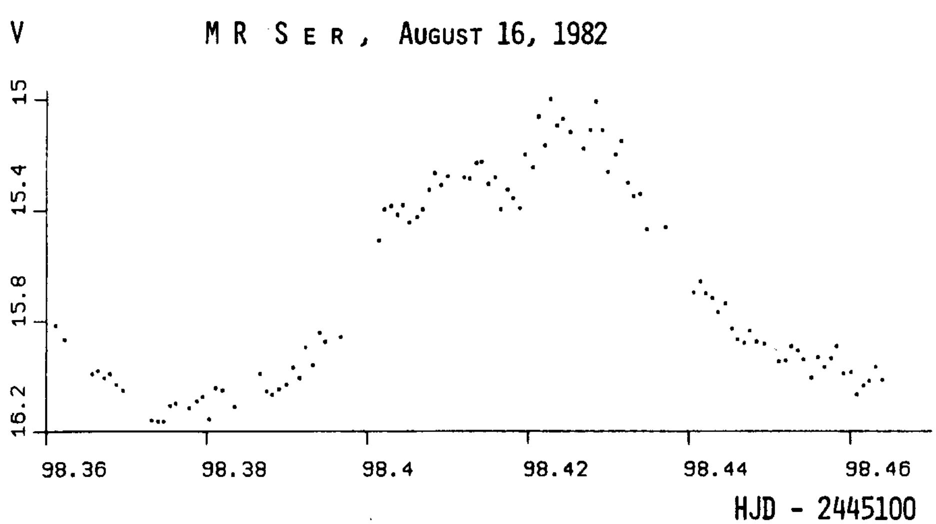

Figure 1

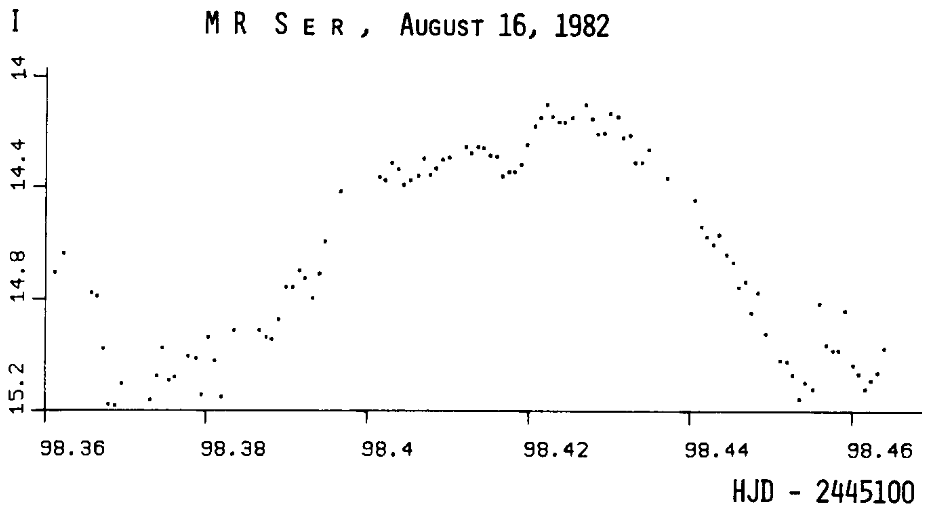

Figure 2

For approximately 2.5 hours (1.3 orbital periods) on August 16, 1982, we observed MR Ser photometrically with the 1.23 m telescope on Calar Alto (Spain). Measurements were carried out sequentially in V and I light using a one-channel photometer with a RCA31034 multiplier. The observations were made in a quasi-high-speed mode (i.e. sky and comparison star were measured only about every 30 minutes) with integration times of 16.8 seconds per filter; including dead times the time resolution in each filter was normally 64.8 seconds. The star at 223 arcseconds north and 153 arcseconds east of the object was chosen as comparison star. Using classical photometric measurements with several standard stars, taken on another night, its colours were determined to be

$$V = 11.^{m}385$$
$$(V-I) = 0.^{m}807$$

All data were reduced with the high-speed reduction software on a Cyber 145 at the Institute of Astronomy of the University of Munich.

The V and I measurements we obtained are shown in Figs 1 and 2. The variation in both energy bands is of roughly the same shape and amplitude, with moderately strong flickering present in both. The hump in I both starts slightly earlier and lasts slightly longer than in V. A dip shortly before hump maximum occurs at the same time in both colours and has about the same shape in both within the accuracy of the measurements. This behaviour clearly is reflected in the (V-I) colour curve (Fig. 3): for most of the orbital cycle the colour is variable about the same average value when changes seem to be due mostly to flickering; during mid-rise and mid-decline of the hump the system becomes redder. Colours are the most stable at the time of halt immediately preceeding the dip, until the minimum of the dip is reached.

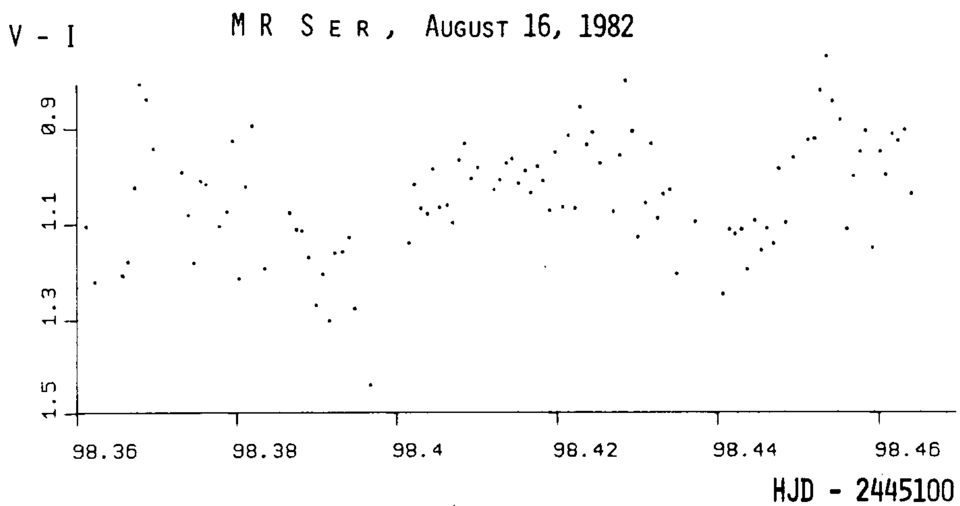

Figure 3

Liebert et al. (1982) have published orbital light curves of MR Ser in V and R2 which, however, were not taken simultaneously but one (R2) immediately after the other (V). The gross appearance of their and our light curves is the same; when compared, our light curves and both of theirs show differences in detail. The V light curve in Liebert et al. shows a very pronounced hold on the ascending branch of the hump and only a minor dip shortly before hump maximum; the hold is not seen in the R2 light which was recorded at the very next orbital cycle. At this point, however, the pre-maximum dip is fairly pronounced, and the shape of this light curve more resembles the shape of ours'. The fact that our (simultaneous) light curves in V and I are quite similar to each other in shape, together with the observation that the V and R curves that Liebert et al. recorded are decidedly different (from each other and from ours) is an indication that on orbital time scales the light of MR Ser is fairly variable, maintaining only approximately the general shape of the light curve.

In the V and R2 observation by Liebert et al. the little dip before hump maximum appears at about the same orbital phase according to the ephemeris and period they derived from the recurrence times of the linear polarisation pulse. The accuracy of the period they give should be sufficient to assign phases to our observations within 0.07 of a period. When doing this, phase zero should occur at HJD 2445198 428 $\pm$ 0.005, which is shortly after hump maximum, whereas it is expected to be at the rising branch before the dip if one assumes a stable relation between the photometric variation and the linear polarization. Thus the error in the period Liebert et al. give seems to be slightly larger than indicated. Furthermore, we are not able to determine whether or not the pre-maximum dip, that seems to be a stable feature in the light curve, always appears at the same orbital phase in V. Since we did not obtain linear polarimetric measurements, we are also not able to improve the period determination of MR Ser.

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