UPPER LIMITS FOR THE LUMINOSITY OF A dM COMPANION IN AM HERCULIS OBJECTS

S. Tapia and G. V. Coyne
Steward Observatory and Lunar and Planetary Laboratory
Tucson, Arizona

SUMMARY*

The quest for optical identification of X-ray sources has revealed a new class of variables currently formed by AM Her, AN UMa, VV Pup, and the most recent member, 2A 0311-227 (for which a variable star designation will be available soon). These objects show many of the variations common to close binary systems where mass transfer is under way. However, they are distinguished by the high degree (10 to 35 %) of linear and circular polarization observed in the optical and near infrared spectral regions. Apparently the polarization is due to cyclotron emission of electrons located in a region where the magnetic field strength is about 10^8 gauss.

Synchronized periodic variations of the polarization and the X-ray flux suggest that the magnetic field originates in an accreting degenerate dwarf star. In such systems formation of an accretion disk is prevented by the strong magnetic field which channels the inflow of plasma towards the magnetic polar caps, forming accretion columns. The X-ray luminosity and probably the bulk of the optical luminosity are produced in the accretion columns.

Sporadic states of low luminosity, up to 5 mag fainter than the bright state, are also observed in AM Herculis objects. According to the model of magnetically confined accretion, the low states indicate drastic reductions of the mass transfer rate with comparable reductions off efficiency from the emission mechanisms taking place at the polar caps and in the accretion columns. The optical and infrared polarization should be especially affected by the low states because, aside from the reduction in efficiency of cyclotron emission, the polarization is expected to be diluted by the relatively larger contribution of unpolarized flux from stellar components. Nevertheless, observations of AM Her, AN UMa, and VV Pup obtained during states of low luminosity reveal that the degree of circular polarization remains practically unchanged

M. J. Plavec, D. M. Popper and R. K. Ulrich (eds.), Close Binary Stars: Observations and Interpretation, 471–472.

and the values measured at 0.70 and 0.85 μm place strict upper limits on the luminosity of a dM type companion.

*This summary was submitted before the meeting; no update has been received. (Editorial remark).

DISCUSSION FOLLOWING THE PAPER BY TAPIA AND COYNE

Mayo: The secondary might show up at longer wavelengths, i.e. in the IR bands in the light curves. In particular, those systems that are observed to eclipse in the optical, render it possible to observe a secondary eclipse at IR wavelengths.

Tapia: I am not sure that we observe star eclipses in the optical light curves of these systems. I agree that your suggestion should be pursued by infrared observers.

Friedjung: Can you give a minimum absolute magnitude for the red component?

Tapia: If we use the current information on the distance of these objects, that is approximately 100 pc, the derivation of absolute magnitudes is trivial. However, I do not think that we step into safe grounds if we assume that they are bona fide M dwarfs.

Whelan: One way of seeing if the disc changes is to measure its electron density, possibly by use of the Balmer emission lines. Since you have access to excellent detectors, will you attempt this?

Tapia: The data is in the drawer!

https://doi.org/10.1017/S0074180900065335 Published online by Cambridge University Press