

DETECTION OF THE IRRADIATED RED DWARF: IN THE OLD NOVA WY SGE (NOVA 1783)

M.W. SOMERS¹, K. MUKAI², T. NAYLOR¹, F.A. RINGWALD¹

*1. Department of Physics, Keele University, Staffordshire ST5
5BG*

*2. Office for Guest Investigator Programs, Code 668, NASA/Goddard
Space Flight Center, Greenbelt, MD 20771, USA*

Abstract. We present IR photometry and optical spectroscopy of the eclipsing old nova WY Sge. According to hibernation theorists the disc in a system a few centuries after outburst should be significantly fainter than in other more recent old novae, but similar to the discs of dwarf novae in quiescence.

Despite the apparent faintness of the late type star we have sufficient information to infer that the face closest to the white dwarf is irradiated.

1. Results

1.1. INFRARED PHOTOMETRY

The flux remaining in eclipse provides an upper limit to the contribution of the late type star. It implies that the late type star in WY Sge provides less than 50% of the flux at K. Comparison with dwarf novae (Szkody & Mateo 1986) shows that all have the secondary star contributing around 63% of the flux or more at K (assuming all the disc light is eclipsed). If we limit ourselves to systems with a period greater than three hours (and thus a similarly sized secondary to WY Sge) the secondary star provides greater than 76% of the light in all cases, with greater than 91% for the two eclipsing systems given (U Gem, IP Peg). The fraction of light from the late type star in the non-eclipsing novalike variable IX Vel (Haug 1988) at K is about 20-40% in agreement with WY Sge.

At K maximum light occurs at phase 0.32 ± 0.01 which implies that the out of eclipse modulation is not purely ellipsoidal. We have modelled this

in terms of a gravity and limb darkened Roche lobe being irradiated by a source at the position of the white dwarf and shaded by the disc.

1.2. SPECTROSCOPY

The spectra taken in the red arm of ISIS on the WHT were shifted and added on (K_2) derived from the narrow line emission. Several absorption features are apparent, most noticeably the TiO bands. We use the flux density deficit method in the TiO bands (Wade and Horne 1988) to calculate the fraction of light originating from the late type star and its spectral type. The secondary is of spectral type M1-M5 with a best estimate of M4.

The ISIS blue arm spectra covered the region around HeII and $H\beta$. In the individual spectra it is apparent that there is a sharp component of the $H\beta$ profile that moves with phase. The narrow component is phased correctly to be tracing the velocity of the late type star, it is anti-phased with the inner disc which roughly coincides with the velocity of the white dwarf. Narrow line emission is indicative of irradiation of the inner face of the late type star.

2. Conclusions

We show that, contrary to the predictions of hibernation theory, WY Sge appears to have a brighter disc, at both infrared and optical wavelengths, than other similar period and inclination dwarf novae. The disc is of comparable brightness as that in the novalike variable IX Vel.

We also find that the secondary is irradiated on the face closest to the white dwarf. The origin of the irradiation is unclear, it is either the remnant heating from the cooling white dwarf after the nova explosion or accretion irradiation.

3. References

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