VW HYI: A RAPIDLY COOLING WHITE DWARF?

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Abstract. We estimate the post-outburst cooling time-scale of the white dwarf in VW Hyi, using the available quiescent IUE spectra. The determination of the white-dwarf temperature close to the outburst is hampered because disc emission still contributes to the SWP flux.

1. Introduction

Observations of the inter-outburst behavior of dwarf novae in the UV range are important in order to study the evolution of the disc/boundary layer as well as the possible cooling of the (accretion–heated) white dwarf. Alas, the white dwarf could be detected directly only in a small number of dwarf novae. The cooling of the white dwarf has been observed in U Gem (Long et al. 1994), WZ Sge (Sparks et al. 1993) and OY Car (Cheng et al. 1994). In the case of VW Hyi, Verbunt et al. 1987 detected a decline of the UV flux after an outburst, which has been interpreted by Meyer & Meyer-Hofmeister (1994) by the evaporation of the inner (hot, UV–emitting) accretion disk. On the other hand, Sion et al. (1995) clearly identify the white dwarf in HST spectra.

2. Analysis & results

We have retrieved all available IUE spectra of VW Hyi from the ULDA archive and selected 58 SWP/LWR/LWP spectra obtained in quiescence. The UV flux shows an exponential decline, decreasing markedly slower after a superoutburst (Fig. 1). The individual spectra can be fitted reasonably well with $\log g = 8$ white-dwarf model spectra by Ivan Hubeny, with the largest discrepancy in the LWP range. The radii derived for a distance of 65 pc (Fig. 1) are compatible with the assumed 0.6 $M_\odot$ white dwarf. Optical spectroscopy obtained in 1989 January shows the known orbital

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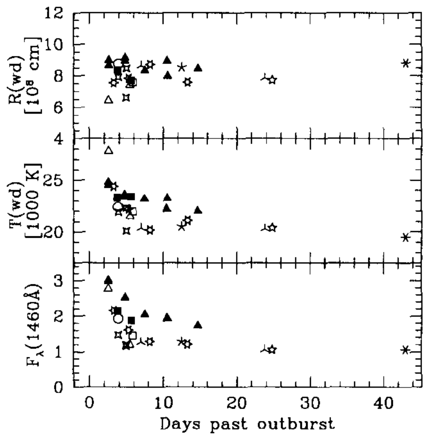

Figure 1: VW Hyi on the decline from the outburst. (a) UV flux in 10^{-13}ergs $cm^{-2}s^{-1}Å^{-1}$. Spectra taken after a normal outburst and after a superoutburst are indicated by open and filled symbols, respectively. (b) Effective temperatures derived from fitting white-dwarf models to the observed Lyα profile. (c) Radius of the emitting area at $d = 65$ pc.

modulation, presumably due to the varying aspect of the hot spot. Fitting the spot spectrum with Kurucz low-gravity models yields a temperature of ~ 10 000 K, in agreement with the estimate of Mateo & Szkody (1984). The contribution of the hot-spot in the LWP range is ~ 10%, consistent with the departure of the observed spectra from the white-dwarf models.

Taken at face value, the temperatures derived from fitting the observed Lyα profiles with white-dwarf models indicate that the white dwarf cools between two outbursts from ~ 25 000 K to ~ 20 000 K. The cooling time-scale seems to be of the same order as the duration of the preceding outburst, i.e. ~ 5 d after a normal outburst and ~ 15 d after a superoutburst. However, our ongoing analysis of the IUE spectra confirms the results by Huang et al. (1996) who show that an HST spectrum taken 10 d after a normal outburst contains a non-negligible contribution of a disc remnant. For the two spectra closest to the previous outburst, we find that the disc still contributes ~ 60% (normal , △) and ~ 30% (super, ▲) of the SWP flux, these spectra require a more detailed discussion. The spectra taken 24, 25 and 43 d after the outburst show no further evolution and are compatible with a white dwarf of $T_{wd} \simeq 20\,000$ K without noticeable disc contribution.

References

Cheng, F.H., Marsh, T.R., Horne, K., Hubeny, I., 1994, AIP conf. proc. **308**, 197

Huang, M., Sion, E.M., Hubeny, I., et al., these proceedings, p247

Long K.S., Sion, E.M., Huang, M., Szkody, P.,1994, Ap. J., **424**, L49

Mateo, M., Szkody, P., 1984, AJ, **89**, 863

Meyer, F., Meyer-Hofmeister, E., 1994, A&A, **288**, 175

Sion, E.M., Szkody, P., Cheng, F.H., Huang, M., 1995, Ap. J., **444**, L97

Sparks, W.M., Sion, E.M., Starrfield, S.G., Austin, S., 1993, in "Cataclysmic Variables and Related Physics", eds O. Regev, G. Shaviv, Ann. Israel Phys. Soc., **10**, 96

Verbunt, F., Hassall, B.J.M., Pringle, J.E. et al., 1987, MNRAS, **225**, 113