Spectroscopy of the candidate pre-CV LTT 560

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Abstract. We present preliminary results on spectroscopic data of the candidate pre-cataclysmic variable LTT 560. A fit to the flux-calibrated spectrum reveals the temperature of the white-dwarf primary to be $T_{\text{eff}} = 7000 - 7500$ K, and confirms the result of previous studies on the detection of an M5V secondary star. The analysis of radial velocity data from spectral features attributed to the primary and the secondary star show evidence for low-level accretion.

Keywords: spectroscopy, cataclysmic variables, evolution

1. Introduction

LTT 560 is a high proper motion system from the Luyten (1957) catalogue. A first photometry has been presented by Eggen (1968), who marked the object as a possible white dwarf (WD). It was later included as a nova-like variable in Vogt (1989), and appeared as such in the Downes et al. (1997) catalogue of cataclysmic variables (CVs) with the designation Scl2. A first spectrum was published by Hoard & Wachter (1998), who found narrow H$\alpha$ emission and a red continuum that was fitted well by an M5 dwarf. Their data did not cover the blue part of the spectrum, so that they could not identify any contribution from the WD. However, a variable doubling of the H$\alpha$ emission in their spectra let them deduce the binary nature of the object. Light curves presented by Tappert et al. (2004) showed ellipsoidal variation with a period $P_{\text{ph}} = 3.54$ h, thus revealing LTT 560 as a potential pre-CV.

2. The flux-calibrated spectrum

In order to investigate the different stellar components, an optical spectrum was taken on 2003-07-19 with EMMI at the NTT, ESO La Silla. The data is shown in Fig. 1 together with the best fit, which comprises of a $T_{\text{eff}} = 7000$ K, $\log g = 8.0$ WD and an M5.5 dwarf.
Fits with $T_{\text{eff}} = 7500$ K, $\log g = 8.5$ work equally well, as does an M5V star as secondary component. This confirms the earlier result by Hoard & Wachter (1998) on the secondary, and establishes LTT 560 as containing the coldest WD in a pre-CV besides RR Cae ($P_{\text{orb}} = 7.3$ h), which has $T_{\text{eff}} = 7000$ K, and with an M6V star also contains a secondary of similar spectral type (Bragaglia et al., 1995, Bruch & Diaz, 1998; see also Schreiber & Gänsicke, 2003, for a discussion in the context of CV evolution).

3. Radial velocities and line profiles

Time-resolved spectroscopy was taken on 2004-11-29 with the 4 m telescope at CTIO, Chile. A spectral range of 3500–7300 Å was covered at a FWHM resolution of 4.2 Å. Radial velocities were measured by fitting single Gaussians to several spectral features (Fig. 2). With this preliminary simple fit, especially the curve of the WD absorption ($\text{H}\beta$) therefore probably does not reflect well the true white dwarf radial velocity variation. This could explain why the parameters of the corresponding radial velocity curves yield mass ratios and phase offsets that are not conform with a pre-CV configuration. On the other hand, also the amplitudes for the two features attributed to the red
Figure 2. Left: Radial velocities of the Hα emission (top), a TiO absorption edge near λ7040 Å (middle), and the Hβ absorption line (bottom). The data have been folded on the 3.54 h period. Zero phase has been set to the first data point of the spectroscopy. Right: Trailed spectrogram of the region around Hα.

dwarf show significant discrepancies ($K_{\text{H} \alpha} = 164(06) \text{ km s}^{-1}$, $K_{\text{TiO}} = 207(07) \text{ km s}^{-1}$).

A closer inspection of the Hα line profile shows the doubling at certain phases that had already been detected by Hoard & Wachter (1998). It is obviously caused by two counterphased components of different strength, with the weaker one having a lower amplitude and disappearing at phases 0–0.3.

4. Conclusions

The general composition of LTT 560 appears clear. It is a binary star consisting of an M5-6V secondary star and a cold ($T_{\text{eff}} \approx 7000 \text{ K}$) WD primary. The current orbital period amounts to 3.54 h, and, if the pre-CV configuration applies, the system should thus evolve into a semi-detached CV within Hubble time.

The derivation of other system parameters still need a more thorough examination of the present data. The velocities of the WD ab-
sorption line are not yet reliable due to an insufficiently precise measurement of the WD absorption line. They will therefore be revised using a more sophisticated method. Furthermore, the Hα velocities are probably distorted due to the presence of an additional component.

Emission line doubling has been detected, e.g. also in the candidate pre-CV HS 2237+8154 (Gänsicke et al., 2004), but there it is due to a component that appears to be stationary at the system velocity. In LTT 560, this is clearly not the case. Since it is roughly in counterphase with the other component and the TiO band, it has to origin in some region beyond the centre of mass as seen from the secondary star, i.e. in the vicinity of the WD. A rough estimate of its semi-amplitude yields $K \approx 100 \, \text{km s}^{-1}$, thus, with respect to TiO, leading to much more plausible system parameters, e.g. a mass ratio $q \approx 0.5$. Still, this has to be confirmed by a more detailed analysis.

We conclude that our data shows evidence for emission from, or close to, the WD. It might be caused by sporadic accretion, e.g. due to wind from the secondary star. Accretion due to Roche lobe overflow appears less likely, since the late spectral type of the secondary implies that a semi-detached configuration is not expected for periods longwards of 2 h (e.g. Beuermann et al., 1998).

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