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Spectral Analysis of Extremely Hot, Accreting White Dwarfs

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For the spectral analysis of hot, compact stars, advanced model atmospheres that consider deviations from the local thermodynamic equilibrium (LTE) are mandatory. The Tübingen Non-LTE Model-Atmosphere Package (*TMAP*) can calculate such model atmospheres and spectra at a high level of sophistication. These Non-LTE spectra can be used, e.g., for the analysis of accreting white dwarfs in cataclysmic variables.

Novae V4743 Sgr, KT Eri, and NSMC 2016

In the following, we demonstrate for three novae, that our plane-parallel, hydrostatic, fully metal-line blanketed *TMAP* models are well suited for the spectral analysis of super-soft X-ray sources (SSS).

V4743 Sgr in outburst was analyzed by Rauch et al. (2010), who used *TMAP* models and *Chandra* and *XMM-Newton* grating spectra. Although the velocity field and the expansion of the nova's atmosphere was neglected, the overall slope of the continuum flux was well reproduced (Fig. 1). Moreover, the strengths of prominent photospheric absorption lines (C V, C VI, N VI, N VII, O VII) as well as the strengths of absorption edges were in very good agreement with the observation. It appears most likely that the mass-loss rate has already decreased strongly at the beginning of the SSS phase and, the photospheric lines appear blue-shifted (cf., Ness et al. 2003, Fig. 1) but the impact of the stellar wind on the continuum flux is not significant.

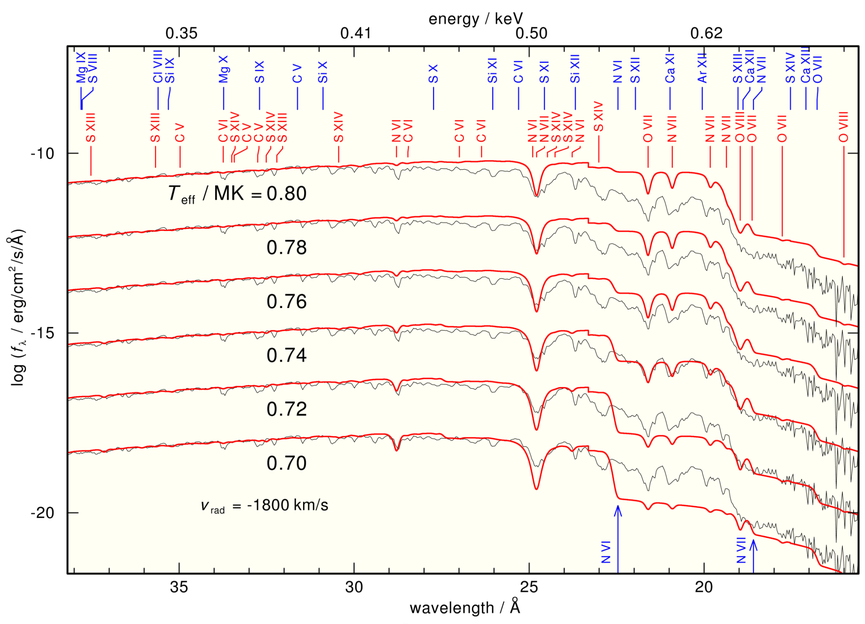

Fig. 1. Comparison of *TMAP* spectra (log (g / cm/s^2) = 9) and a *XMM* observation of V4743 Sgr. Absorption thresholds are marked at top (blue), spectral lines below that (red).

KT Eri spectra were obtained by *Chandra* in 2010 and analyzed using *TMAP* spectra (Fig. 2, Drake et al. in prep.). Like measured in V4743 Sgr (Fig. 1), the maximum effective temperature (T_{eff}) is about 0.74 MK.

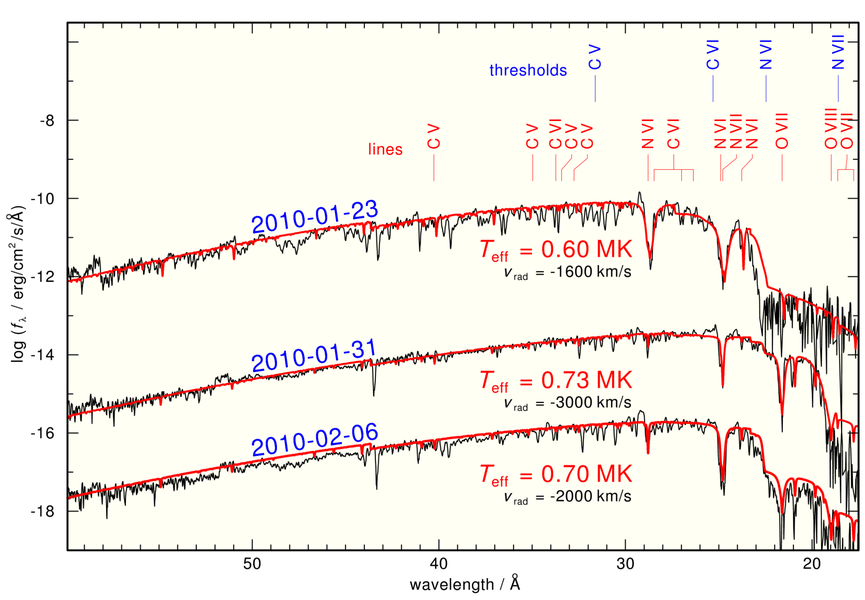

Fig. 2. Comparison of *TMAP* models (log *g* = 9) with *Chandra* observations of KT Eri at different times. The 2010-01-31 observation is shifted by -3 in log f_λ, 2010-02-06 by -5, for clarity.

NSMC 2016 had been observed twice by *Chandra* (HRC-S, LETG), in Nov 2016 and Jan 2017, at the days 39 and 88 after its optical maximum (Orio et al. 2018). In Fig. 3, we show the comparison of our *TMAP* models with the day-39 observation. We determined $T_{eff} = 0.65 \pm 0.05$ MK.

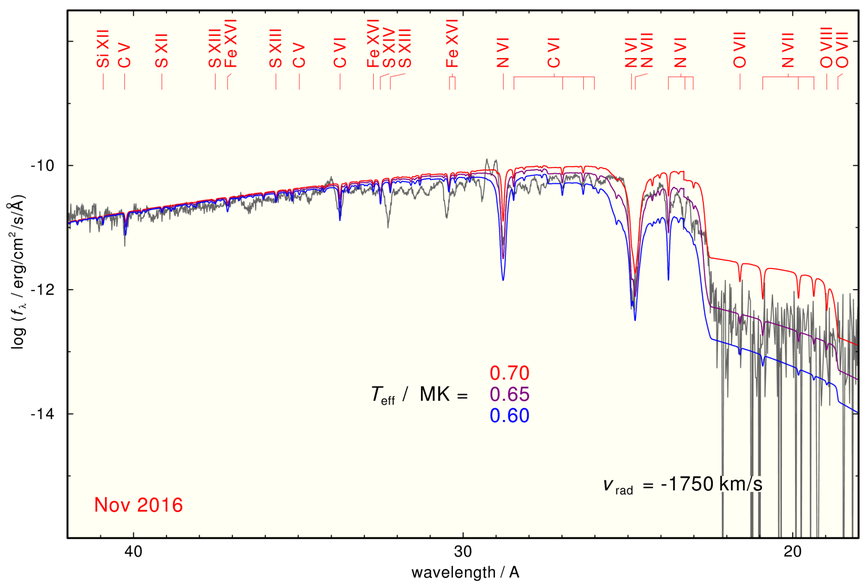

Fig. 3. Comparison of *TMAP* spectra (log g = 9) and the *Chandra* observation of NSMC 2016 (day 39). Prominent spectral lines are marked at top (red).

Access to Synthetic SSS Spectra

TMAP spectra for SSS are available via the German Astrophysical Virtual Observatory (GAVO) service *TheoSSA* (http://dc.g-vo.org/theossa). FITS files to be used as atables within XSPEC can easily be retrieved via http://astro.uni-tuebingen.de/~rauch/TMAF/flux_HHeCNONeMgSiS.html.

References
Ness, J.-U., et al. 2003, ApJ, 594, L127
Orio, M., et al.2018, ApJ, 862,164
Rauch, T., et al. 2010, ApJ, 717, 363

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