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The X-ray emission of the intermediate polar V709 Cas

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Abstract. *RXTE* and *BeppoSAX* X-ray data of V709 Cas acquired in 1997 and 1998 reveal new temporal and spectral characteristics which are interpreted in terms of current accretion scenarios for intermediate polars (IPs).

1. Timing and spectral analysis

Discrete Fourier Transforms (DFTs), performed on the *RXTE*/PCA March 1997, and on the *BeppoSAX*/MECS July 1998 data in the 1–10 keV range, show the dominance of the 312.8 s spin period (Norton et al. 1999) and a strong second harmonic, whose relative amplitudes are larger in 1998 by a factor ~ 1.6. The first harmonic is only detected in the 1998 observation (Fig. 1). Pulses are detected up to 30 keV and are in phase at all energies. Amplitudes increase at lower energies and a spectral hardening is found at spin minimum as the accretion curtain model (Rosen, Mason, & Cordova 1988) predicts.

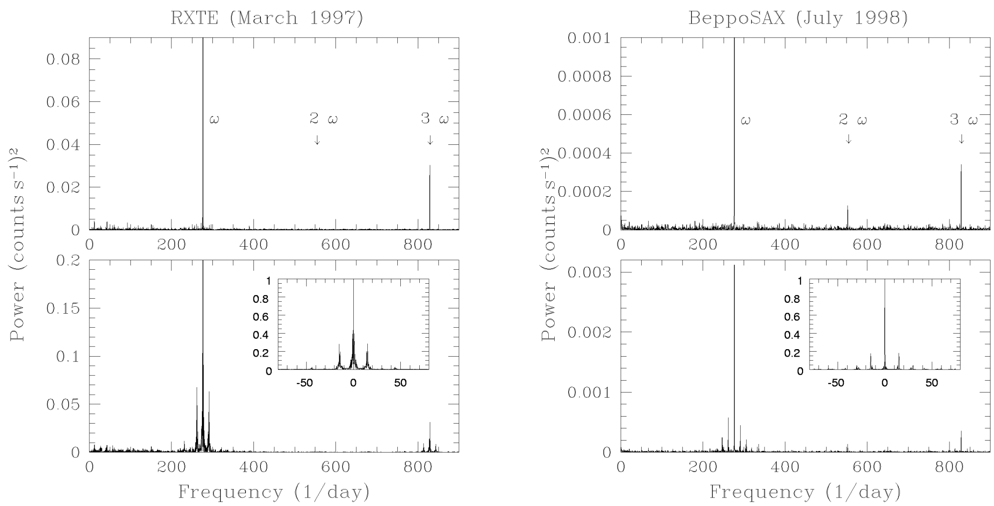

Figure 1. **Lower panels:** *RXTE* and *BeppoSAX* DFTs and spectral windows. **Upper panels:** Windowing effects are removed in the CLEAN spectra.

The spin average 0.1–70 keV *BeppoSAX* spectrum was fitted with an isothermal plasma (MEKAL model) at 42 keV together with a total ($N_H = 8.7 \times 10^{20}\,cm^{-2}$) and partial covering ($C_F = 0.29$, $N_H = 2.9 \times 10^{22}\,cm^{-2}$) absorbers and with a 6.4 keV gaussian line (E.W.=218 eV) (χ^2_ν=1.18). Abundances are within errors consistent with the solar value. The large E.W. of iron fluorescent line is likely affected by reflection from the white dwarf surface. Adding a Compton reflection continuum, the plasma temperature (27 keV) and fluorescent line E.W. get lower, but with a modest improvement of the fit quality. The *RXTE* (3–20 keV) average spectrum, fitted with similar components (the local absorber is total here), instead requires an additional contribution from an absorption edge at ∼8.1 keV, corresponding to Fe XIX–XXII, and an optical depth $\tau = 0.11$ ($\chi^2_\nu = 1.23$). This is the first detection of an ionized absorber in an IP. The E.W. of K_α line and the partial covering component increase at spin minimum, as expected by the curtain model. Differently from reflection, tall shocks above the accreting poles (Mukai 1999) can easily explain the same phasing of high and low energy pulses, with the main pole always visible and the secondary coming into view for ∼ 40% of a cycle. We estimate $h \sim 0.04 - 0.06\,R_{WD}$. The decrease in flux (a factor of ∼ 1.5) and the increase of pulse amplitudes between 1997 and 1998 suggest a decrease in the mass accretion rate. At higher rates the effects of absorption are larger and part of the local absorbers may become ionized thus reducing the modulation amplitudes.

References

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