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Unveiling hidden variability components in Cyg X-1 and their connection to the radio jet

The study of fast variability properties in X-ray binaries advances our understanding of the properties of the accretion flow around the compact object. As most timing studies focus on the power spectrum (PS), the phenomenology of the cross spectrum (CS), especially the coherence, is less understood. In this talk, I will present the results of a systematic study of the evolution of both PS and CS of Cygnus X-1 with AstroSat/LAXPC, during the transition of the source from the hard to soft state in 2017. Using a novel technique to fit simultaneously the PS and CS with a multi-Lorentzian model, and predicting the phase-lags and coherence-frequency spectra, we study the evolution of the frequency and power of the five main variability components that are present throughout all the states. Additionally, we identify previously undetected variability components, one of which manifests as a narrow dip in the coherence function and a broad drop in the phase-lag spectrum at the same frequency. This dip in coherence, which we detected for the first time in Cygnus X-1 at energies above 3 keV, had only been previously detected with NICER data when a soft reference band (< 2 keV) was used. Moreover, these dips appear in a state in which the source shows high-amplitude radio variability and significant hard X-ray polarization. While the contribution of the compact jet in X-rays is debated in the literature, this study provides a new avenue for investigating jet properties as well as the geometry of the Comptonizing medium.

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