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Timing Analysis of the Black-Hole Candidate Swift J1727.8−1613: Detection of a Dip-like Feature in the High-Energy Cross Spectrum

The energy-dependent variability of black hole X-ray binaries (BHXRBs) provide crucial insights into the physical processes at play in the accretion flow of these systems. We analyze the rapid X-ray variability of the BHXRB Swift J1727.8-1613 during its 2023 outburst, using observations from the Hard X-ray Modulation Telescope. We detect, for the first time, a dip-like feature in the Real part of the Fourier cross spectrum of this source from the >25 keV and <10 keV X-ray light curves in the 3-15 Hz frequency range. This feature implies a phase lag between $\pi/2$ and π. We modeled the variability and found that a Gaussian phase-lag model provides a better fit than simpler models, reducing ambiguities in interpreting the data. Interestingly, both the fractional-rms and phase-lag spectra of the dip exhibit a change in trend around 15 keV, closely aligning with predictions from the time-dependent Comptonization model vKompth under a low feedback factor scenario. I will discuss these findings, and their consequences upon the current understanding of the mechanisms that produce the fast X-ray variability.

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