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Testing the Lense–Thirring Precession Origin of QPOs in Swift J1727.8–1613: Constraints from Disc–Corona Radii and QPO Frequencies

We present a comprehensive spectral and timing analysis of the newly discovered black hole transient Swift J1727.8–1613, based on broadband (2–150 keV) observations from Insight-HXMT during its 2023 outburst. Using the flexible, energy-conserving SSsed model, we identify the presence of both thermal and non-thermal Comptonization components in the hard component dominated state. We track the evolution of the truncated accretion disc radius, r_{cor}, which decreases from 45\,$R_{\rm g}$ to 9\,$R_{\rm g}$, consistent with the transition from the hard to the intermediate state. Additionally, we explore the correlation between r_{cor} and the centroid frequency of quasi-periodic oscillations (QPOs; $\nu_{\rm c}$) to test the hot flow Lense-Thirring (LT) precession model. The overall slope of the observed trend is in strong agreement with the predictions of LT precession, despite the complexities of accretion behavior. Nonetheless, slight deviations from the expected $\nu_{\rm c}$-r_{cor} relation suggest the presence of additional influencing factors, such as uncertainties in system parameter measurements, inner disc flipping, or jet power losses.

Contribution

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