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Accretion Disk evolution across State Transitions in GX 339–4: Broad-Band Spectral Insights from NuSTAR, NICER, and Insight–HXMT

I will present results from a coordinated spectral study of the black hole X-ray binary GX 339–4 during its 2021 outburst, capturing its transition from the hard to soft accretion state. Using simultaneous observations from NuSTAR, NICER, and Insight–HXMT, we applied relativistic reflection models to track changes in the accretion disk, particularly the inner disk radius (□□□). Interestingly, in models with only a hard Comptonization component, □□□ appears smaller in the hard state than in the soft—contrary to standard expectations. However, when we include a warm Comptonization component, this trend reverses, revealing a physically consistent picture with a larger □□□ in the hard state. Assuming the disk extends to the ISCO in the soft state, we estimate the black hole mass as a function of distance. Across all cases, we observe a clear increase in both accretion rate and Eddington ratio as the source softens. These findings highlight the importance of spectral model choice and demonstrate the value of broad-band coverage for understanding accretion physics during state transitions.

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