W04a Transition Luminosities of Galactic Black Hole Binaries with Swift/XRT and NICER/XTI observations

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Galactic black hole transients (GBHTs) show distinct X-ray spectral states at different X-ray luminosities in their outbursts. The state transitions have been linked to changes in the mass accretion rate and a narrow distribution of transition luminosity of GBHTs based on RXTE data (3−25 keV) has been found in previous studies (Macarone 2003). This Eddington ratio at the transitions is often used in recent studies with instruments covering softer energy bands (below1 keV to 10 keV). However, the X-ray states characterized by the spectral parameters may have different definitions depending on the energy ranges adopted in the spectral analysis, leaving the question whether the distribution of transition luminosity obtained with RXTE remains the same when using the instruments covering softer energy bands. In this work, we investigated the state transitions and the variations of luminosities for 8 outbursts using Swift/XRT or NICER/XTI data (0.3−10 keV). Comparing the results from the Swift and RXTE spectra obtained in the same outbursts, we found that the overall trends in spectral parameters around the transitions are generally similar between RXTE and Swift, although the specific values of parameters can be different. Our results show that the bolometric power-law luminosity is constrained tightly to 1% Eddington luminosity when the photon index starts to decrease towards the hard state. It is consistent with the conclusions from previous RXTE results (Vahdat et al. 2019). Our results also suggest that the disk truncation starts after bolometric disk luminosity drops below 1% Eddington luminosity.