

Contribution ID: 71

Type: Flash-talk

Evidence for enhanced mass transfer in the disc preceding the transition to the soft state in MAXI J1820+070

We investigate the 2018 main outburst and the subsequent mini-outbursts of the black hole low-mass X-ray binary MAXI J1820+070 using optical/ultraviolet data from the Las Cumbres Observatory (LCO), the American Association of Variable Star Observers (AAVSO), and SWIFT/UVOT, as well as X-ray data from Insight-HXMT and SWIFT/XRT. Given the high-cadence observations, we identify a broad dip-like feature in both the optical and X-ray light curves preceding the transition to the soft state, with the X-ray dip lagging the optical dip by approximately 10 days. We propose that the dip is caused by a brief decrease followed by an increase in the mass accretion rate as it propagates through the disc, ultimately triggering the transition to the soft state. This might be a potential tool to predict impending hard-to-soft state transitions, although such a dip has not yet been observed in many sources. Additionally, we find that optical colour (g'-i') becomes bluer and less variable before the transition to the intermediate state, preceding a dramatic change in the hardness ratio. This appears to be an unusual case, differing from the typical scenario where the optical colour changes usually along with the transition to the soft state. Finally, we explore the implications of the complex evolution of optical/X-ray correlation during both main outbursts and mini-outbursts. In particular, we find a loop-like evolutionary track before the transition to the soft state, which is linked to the optical/X-ray dips in the light curves.

Contribution

Oral talk

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Session Classification: Flash-talk

Track Classification: Flash-talk