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A possible overall scenario for the outburst evolution of MAXI J1820+070 revealed by Insight-HXMT

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We study the spectral and temporal properties of the black hole X-ray transient binary MAXI J1820+070 during the 2018 outburst with Insight-HXMT observations. The outburst of MAXI J1820+070 can be divided into three intervals. For the two intervals of the outburst, we find that low-energy (below 140 keV) photons lag high-energy (140-170 keV) ones, while in the decay of the outburst, high-energy photons lag low-energy photons, both with a time scale of the order of days. Based on these results, the canonical hysteresis effect of the 'q' shape in the hardness-intensity diagram can be reformed into a roughly linear shape by taking into account the lag corrections between different energy bands. Time analysis shows that the high-frequency break of hard X-rays, derived from the power density spectrum of the first interval of the outburst is in general larger and more variable than that of soft X-rays. The spectral fitting shows that the coverage fraction of the hard X-rays drops sharply at the beginning of the outburst to around 0.5, then increases slightly. The coverage fraction drops to roughly zero once the source steps into the soft state and increases gradually to unity when the source returns to the low hard state. We discuss the possible overall evolution scenario of corona hinted from these discoveries.

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