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The Detailed View of LFQPO in the Broadband 0.2–200keV with Insight-HXMT and NICER

We report the X-ray timing results of the black hole candidate MAXI J1820+070 during its 2018 outburst using the Hard X-ray Modulation Telescope (Insight-HXMT) and Neutron Star Interior Composition Explorer Mission (NICER) observations. Low-frequency quasi-periodic oscillations (LFQPOs) are detected in the low/hard state and the hard intermediate state, which lasted for ~90 days. Thanks to the large effective area of Insight-HXMT at high energies and NICER at low energies, we are able to present the energy dependence of the LFQPO characteristics and phase lags from 0.2 to 200 keV, which has never been explored by previous missions. We find that the centroid frequency of the LFQPOs does not change significantly with energy, while the full width at half maximum and fractional rms show a complex evolution with energy. The LFQPO phase lags at high energies and low energies show consistent energy-dependence relations taking the ~2 keV as reference. Our results suggest that the LFQPOs from high energy come from the LT precession of the relativistic jet, while the low-energy radiation is mainly from the perpendicular innermost regions of the accretion disk.

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