MAXI J1820+070 continuing its rapid evolution toward the hard state

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*on **28 Sep 2018; 22:00 UT***
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We report on recent NICER observations of the transient black hole candidate MAXI J1820+070 (ASASSN-18ey).

After spending the initial part of its outburst in the hard state, MAXI J1820+070 made a rapid transition to a softer spectral state in early July (ATel #11820, #11823). NICER monitoring observations show that it remained in this softer spectral state until recently. MAXI, Swift, and radio observations (ATel #12057, #12061, #12064) indicate that the source started a transition toward a harder spectral state between Sep. 21 and 23. Despite near-daily NICER observations of the outburst, the start of this transition occurred during a 4-day gap in our coverage. Swift observations revealed non-monotonic spectral evolution, casting some doubt on whether the source was truly returning to the hard state (ATel #12064). NICER light/hardness curves and a hardness-intensity diagram (see link below) indicate that the source is still continuing its rapid transition towards the hard state, but has not yet reached the same hardness values seen during the initial hard state.

An energy spectrum obtained earlier today (Sep. 28 12:41 UT, 120 s exposure) can be well modelled with a combination of absorbed disk blackbody and power-law components (similar to the Swift spectra analysed in ATel #12064). We find an nH of ~2e21 cm^-2, a disk temperature ~0.22 keV, and a power-law index of ~2.5. The 0.3-10 keV flux (unabsorbed) is 2.95e-8 erg/s/cm^2, with a power-law flux contribution of ~65%. Compared to the Swift spectra from Sep. 25, the disk temperature is lower and the power-law index higher.

In terms of X-ray variability, we observe significant evolution in the rapid variability properties as well. The averaged 0.3-12 keV power spectrum (PDS) from the last ten days before the current transition shows weak power-law noise with an integrated (0.1-100 Hz) strength of ~0.5% rms. The PDS of the first observation after the transition showed much stronger (~4% rms) peaked noise around 2 Hz, with a hint of a weak QPO around 16 Hz. In the days following the 0.1-100 Hz noise increased in strength to ~11% (Sep. 28) and decreased in frequency. Note that in the 2-10 keV band (which is more comparable to the RXTE band) the rms values after the start of the

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transition increased from ~11% to 27%. By Sep. 28 the QPO had decreased in frequency to ~3 Hz and increased in strength as well. On Sep. 27, two (probably harmonically related) QPOs were detected at 5.73+/-0.20 Hz and 10.78+/-0.13, with Q-values of ~5-6 and strengths of ~1.5% rms (~7% in the 2-10 keV band). These are likely type-C QPOs. Combined with the position of the source in the HID and the spectral parameters listed above, the recent power spectral properties are consistent with the MAXI J1820+070 evolving through the hard-intermediate state.

We strongly encourage rapid, simultaneous, multi-wavelength observations of MAXI J1820+070 as it transitions. A file containing the upcoming NICER schedule for the source can be found at the link below.

NICER is a 0.2-12 keV X-ray telescope operating on the International Space Station. The NICER mission and portions of the NICER science team activities are funded by NASA.

Light/hardness curves, hardness-intensity diagram, and scheduled observations

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