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## NICER observations of MAXI J1820+070: Continuing evolution of X-ray variability properties

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on 26 Apr 2018; 20:39 UT

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Subjects: X-ray, Black Hole, Transient

Referred to by ATel #: [11578](#), [11723](#), [11820](#), [11951](#), [12057](#)

The X-ray transient MAXI J1820+070 has been in outburst since its discovery on March 11 2018 (ATel #11399). Observations at various wavelengths, including the optical counterpart ASASSN-18ey (ATel #11400), suggest that the source is a black hole transient in the hard spectral state (e.g., ATel #11418, #11423, #11420, #11426). NICER has been observing the source on a regular basis. Recent NICER observations (April 16-20) reveal variability that remains consistent with a black hole hard state, but with a continuing power-spectral evolution toward higher frequencies. Low-frequency QPOs were previously detected with INTEGRAL (~0.045 Hz on March 27, ATel #11488) and Swift (~0.06 Hz on April 1, ATel #11510). NICER observations on April 16/17 reveal two harmonically related QPOs at 0.125(3) Hz and 0.238(6) Hz. These QPOs have fractional rms amplitudes in the 0.2-12 keV band of 8+/-1% and 4+/-1%, respectively, and Q-values between 3 and 8.

Although the frequencies of the low-frequency QPOs continue to increase, this does not necessarily mean that a state transition is imminent. For example, during the 2000 outburst of the black hole transient XTE J1118+480 the low-frequency QPO increased in frequency from 0.07 Hz to 0.15 Hz, without the source ever leaving the hard state (Wood et al. 2000, ApJ, 544, L45).

Spectrally, no clear evolution has been seen in the last couple of weeks. A NICER 0.5-10 keV spectrum obtained on April 20 can be modeled well with an absorbed, strongly Comptonized low-temperature accretion disk component (kT~0.28 keV, power-law index ~1.65), confirming that the source remains in the hard state. A broad iron line is present as well at 6.7 keV (EW=140 eV). The unabsorbed (NH~1.2e21) 0.5-10 keV flux is 4.5e-8 erg/cm^2/s.

We also obtained a distance measurement for MAXI J1820+070 from the GAIA data archive (Brown et al. 2018; <https://arxiv.org/abs/1804.09365>). The parallax of the source is listed as 0.30+/-0.10 mas, indicating a relatively nearby black hole X-ray binary at a distance of ~3.3 (-0.8/+1.7) kpc. Using the flux quoted above, this distance implies a 0.5-10 keV luminosity of

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- 12608** Optical spectroscopy and photometry of MAXI J1820+070 (ASASSN-18ey) during the large multi-wavelength re-brightening of March 2019
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- 11899** Short-lived episodes of emission line splitting in the candidate black hole X-ray

5.7e37 erg/s, which corresponds to ~6% of the Eddington luminosity for a 8 Msun black hole. This number could be substantially higher when taking into account the flux outside the 0.5-10 keV band.

Finally, we note that further inspection of NICER observations taken during the rise of the outburst between March 12 and March 16 (unabsorbed flux:  $\sim(0.3-1.5)e-8$  erg/cm<sup>2</sup>/s), reveals strong dips in the light curves below 2 keV. While spectral analysis suggests that these dips are due to absorption and/or obscuration (possibly ionized), their nature is not yet fully understood. These dips were no longer seen once the source reached its current flux plateau (after March 21). The presence of the dips could indicate that MAXI J1820+070 is viewed at a relatively high inclination (>70 degrees).

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.

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