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NICER observations of MAXI J1820+070 suggest a rapidly-brightening black hole X-ray binary in the hard state

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*on **15 Mar 2018; 14:24 UT***
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NICER observed the new X-ray transient MAXI J1820+070 (ATel #11399, #11400, #11403, #11404, #11406, #11418, #11420, #11421) on multiple occasions from 2018 March 12 to 14. During this time the source brightened rapidly, from a total NICER mean count rate of ~880 count/s on March 12 to 2800 count/s by March 14 17:00 UTC, corresponding to a change in 2-10 keV modelled flux (see below) from 1.9E-9 to 5E-9 erg cm^{-2} s^{-1}. The broadband X-ray spectrum is absorbed by a low column density (fitting the model given below, we obtain 1.5E21 cm^{-2}), in keeping with the low Galactic column in the direction of the source (ATel #11418; Dickey & Lockman, 1990, ARAA, 28, 215; Kalberla et al. 2005, A&A, 440, 775) and consists of a hard power-law component with weak reflection features (broad iron line and narrow 6.4 keV line core) and an additional soft X-ray component. Approximating the broadband spectrum in XSPEC using a disk blackbody up-scattered into a power-law, all absorbed by neutral gas (tbabs*simpl*diskbb) we find that during March 12-14 the power-law photon index Gamma steepens from 1.54 to 1.62 while the disk blackbody temperature increases from kT=0.16 to 0.185, the disk normalization changes from 1.15E5 to 2.3E5 and the fraction of disk photons scattered into the power-law drops from 0.47 to 0.38. Note that due to the simplified and exploratory nature of the spectral fit, the best-fitting parameter values given here are intended to be indicative and errors are not quoted.

The light curve shows large amplitude flaring on minutes time-scales, with a broadband power spectrum that can be approximated throughout the observations as either a sum of broad Lorentzians or a doubly-broken power-law, with low-frequency break 0.01 Hz and high frequency break ~3 Hz. The integrated 0.1-64 Hz fractional rms is ~40 per cent and depends only weakly on energy. At high frequencies, the power spectrum shows hints (4-sigma single trial probability, in the first half of the data only) for a narrow (5 Hz FWHM) QPO at 66 Hz (with

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11960 The 55 Hz signal we detected in MAXI J 1820+070 is not a QPO
11951 Detection of a 55 Hz high-frequency QPO in MAXI J1820+070 with NICER
11936 Optical timing observations of MAXI J1820+070 with IFI+IQUEYE and AQUEYE+ soon after state transition

fractional rms of 3% in 0.3-10 keV), which disappears as the source flux increases. Although only a tentative detection, the QPO frequency is intriguing, since QPOs have been observed at a similar frequency in two black hole X-ray binaries (GRS 1915+105 and IGR J17091-3624).

Taken together, the hard power-law spectrum, low temperature disk blackbody and large amplitude broadband power spectrum strongly suggest that the source is a black hole X-ray binary that is rapidly increasing in flux through the canonical hard state. This interpretation is consistent with the optical constraints and radio source detection (ATel #11418, #11420). Given the already high flux and low absorbing column and associated extinction, MAXI J1820+070 offers the possibility of observing a hard state rise and possible state transition of an accreting black hole in unprecedented detail. Due to the rapid rise in flux, we advise urgency in scheduling further multiwavelength observations.

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11833 Declining near-infrared flux from the black-hole candidate MAXI J1820+070 (ASASSN-18ey) in transition

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11824 Other low-frequency optical QPO-like features in MAXI J1820+070 detected with IFI+IQUEYE@Galileo

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11820 A rapid state transition in MAXI J1820+070

11756 17-Hour Period in V light from MAXI J1820+070 = ASASSN-18ey

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