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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

### Related

- 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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- 12577** AMI-LA and Swift confirm the multi-wavelength rebrightening of MAXI J1820+070
- 12573** Swift observation of the rebrightening in MAXI J1820+070
- 12567** Rebrightening of ASASSN-18ey = MAXI J1820+070
- 12534** MAXI J1820+070 is close to quiescence
- 12157** MAXI 1820+070 has completed the decline from the recent optical rebrightening following the soft to hard transition
- 12128** Optical brightening of MAXI J1820+070 over the soft to hard transition observed with LCO and the Al Sadeem Observatory
- 12068** MAXI J1820+070 continuing its rapid evolution toward the hard state
- 12064** Swift observes MAXI J1820+070 in transition from the soft to the hard-intermediate state
- 12061** AMI radio detection of the black hole candidate MAXI J1820+070 during the soft to hard transition.
- 12057** MAXI/GSC detection of a rapid increase in the hard X-ray flux of MAXI J1820+070
- 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
- 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.

	binary MAXI 1820+070
11887	LOFAR observations of MAXI J1820+070 (ASASSN-18ey) during its recent state transition
11855	Polarimetric monitoring of the MAXI J1820+070 in optical and near-infrared wavelengths
11833	Declining near-infrared flux from the black-hole candidate MAXI J1820+070 (ASASSN-18ey) in transition
11831	(Sub)-millimetre Observations of MAXI J1820+070 (ASASSN-18ey) Suggest Jet Quenching on July 6
11827	AMI-LA 15.5 GHz observations of radio flaring from the black hole candidate MAXI J1820+070 in transition
11824	Other low-frequency optical QPO-like features in MAXI J1820+070 detected with IFI+IQUEYE@Galileo
11823	Continuing NICER observations of the state transition in ASASSN-18ey/MAXI J1820+070
11820	A rapid state transition in MAXI J1820+070
11756	17-Hour Period in V light from MAXI J1820+070 = ASASSN-18ey
11723	Low-frequency optical QPO in MAXI J1820+070 detected with IFI+IQUEYE@Galileo
11661	KEGS Discovery of 9 Supernova Candidates in the K2 Campaign 17 field with Pan-STARRS PS1
11609	Simultaneous LOFAR and AMI-LA observations of MAXI J1820+070
11596	MAXI J1820+070 has optical period of 3.4 hours
11591	Further detection of the optical low frequency QPO in the black hole transient MAXI J1820+070
11578	Exponential increase in X-ray QPO frequency with time in MAXI J1820+070
11576	NICER observations of MAXI J1820+070: Continuing evolution of X-ray variability properties
11574	Optical/X-ray Flux Decoupling in MAXI J1820+070
11540	VLITE meter-wavelength detection of MAXI J1820+070 at 339 MHz
11539	The 30-day monitoring of MAXI J1820+070 at 4.7 GHz
11533	A bright mid-infrared excess in MAXI J1820+070
11510	Detection of optical and X-ray QPOs at similar frequencies in MAXI J1820+070
11490	INTEGRAL observations of MAXI J1820+070: public data products
11488	Low-frequency QPOs in MAXI J1820+070 as seen by INTEGRAL/SPI
11482	Palomar 60-inch SEDM classification of optical transients

- 11481** MAXI J1820+070: VLT and GTC spectroscopic follow-up shows a significant spectral evolution from the early stages of the outburst
- 11480** ePESSTO spectroscopic classification of optical transients
- 11478** INTEGRAL observations of MAXI J1820+070
- 11462** Near Infrared JHKs observations of the transient MAXI J1820+070 / ASASSN-18ey: Erratum on 2MASS counterpart designation
- 11458** Near Infrared JHKs observations of the transient MAXI J1820+070 / ASASSN-18ey
- 11451** Fast infrared photometry of the black-hole candidate MAXI J1820+070
- 11445** First measurements of linear polarization of MAXI J1820+070
- 11440** NOEMA Sub-millimetre Detection of MAXI J1820+070
- 11439** A flat radio spectrum of MAXI J1820+070
- 11437** Red sub-second optical flaring in MAXI J1820+070 observed by ULTRACAM/NTT
- 11432** Correlated Optical/X-ray Timing Variations in MAXI J1820+070 found by Swift UVOT and XRT
- 11427** The hard X-ray spectrum of MAXI J1820+070 observed by Swift/BAT
- 11426** Detection of 10-msec scale optical flares in the black-hole binary candidate MAXI J1820+070 (ASASSN-18ey)
- 11425** Optical Spectra of MAXI J1820+070 with Keck
- 11424** SOAR/Goodman optical spectroscopy of MAXI J1820+070
- 11423** NICER observations of MAXI J1820+070 suggest a rapidly-brightening black hole X-ray binary in the hard state
- 11421** Fast optical flaring in the suspected black-hole binary MAXI J1820+070 (ASASSN-18ey)
- 11420** ARI radio observations of the black hole candidate MAXI J1820+070
- 11418** Optical observations of MAXI J1820+070 suggest it is a black hole X-ray binary
- 11406** MAXI J1820+070: Errata and updated XRT Position
- 11404** MAXI J1820+070: Swift/UVOT counterpart correction
- 11403** Swift detection of MAXI J1820+070
- 11400** Optical follow-up of MAXI J1820+070 and possible identity with ASASSN-18ey
- 11399** MAXI/GSC detection of a probable new X-ray transient MAXI J1820+070
- 10459** Ongoing radio monitoring of Cyg X-1 with the RATAN-600 radio telescope

[ **Telegram Index** ]

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