NICER observations of MAXI J1820+070

Continuing evolution of X-ray variability properties


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

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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. 2020, ApJ, 900, L15). The parallax of the source is listed as 0.30+/-.010 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"
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: ~(0.3-1.5)e-8 erg/cm²/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.
MAXI J1820+070: VLT and GTC spectroscopic follow-up shows a significant spectral evolution from the early stages of the outburst

EPESSTO spectroscopic classification of optical transients

INTEGRAL observations of MAXI J1820+070

Near Infrared JHKs observations of the transient MAXI J1820+070 / ASASSN-18ey: Erratum on 2MASS counterpart designation

Near Infrared JHKs observations of the transient MAXI J1820+070 / ASASSN-18ey

Fast infrared photometry of the black-hole candidate MAXI J1820+070

First measurements of linear polarization of MAXI J1820+070

NOEMA Sub-millimetre Detection of MAXI J1820+070

A flat radio spectrum of MAXI J1820+070

Red sub-second optical flaring in MAXI J1820+070 observed by ULTRACAM/NTT

Correlated Optical/X-ray Timing Variations in MAXI J1820+070 found by Swift UVOT and XRT

The hard X-ray spectrum of MAXI J1820+070 observed by Swift/BAT

Detection of 10-msec scale optical flares in the black-hole binary candidate MAXI J1820+070 (ASASSN-18ey)

Optical Spectra of MAXI J1820+070 with Keck

SOAR/Goodman optical spectroscopy of MAXI J1820+070

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

Fast optical flaring in the suspected black-hole binary MAXI J1820+070 (ASASSN-18ey)

AMI radio observations of the black hole candidate MAXI J1820+070

Optical observations of MAXI J1820+070 suggest it is a black hole X-ray binary

MAXI J1820+070: Errata and updated XRT Position

MAXI J1820+070: Swift/UVOT counterpart correction

Swift detection of MAXI J1820+070

Optical follow-up of MAXI J1820+070 and possible identity with ASASSN-18ey

MAXI/GSC detection of a probable new X-ray transient MAXI J1820+070

Ongoing radio monitoring of Cyg X-1 with the RATAN-600 radio telescope