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NOEMA Sub-millimetre Detection of MAXI J1820+070

ATel #11440; *A. J. Tetarenko (Alberta), M. Bremer (IRAM), J. Bright (Oxford), G. R. Sivakoff (Alberta), J. C.A. Miller-Jones (Curtin), T. D. Russell (UvA), and the JACPOT XRB collaboration*

on 19 Mar 2018; 16:19 UT

Credential Certification: *Alexandra Tetarenko (tetarenk@ualberta.ca)*

Subjects: Radio, Millimeter, Sub-Millimeter, Black Hole, Transient

Referred to by ATel #: [11451](#), [11458](#), [11478](#), [11481](#), [11510](#), [11723](#), [11831](#)

We performed target-of-opportunity observations of the newly-discovered candidate black hole X-ray binary, MAXI J1820+070 (ATel #[11399](#), #[11400](#), #[11404](#), #[11406](#), #[11418](#), #[11420](#), #[11421](#), #[11423](#), #[11424](#), #[11425](#), #[11426](#), #[11427](#), #[11432](#), #[11437](#), #[11439](#)), with the Northern Extended Millimetre Array (NOEMA), as part of the JACPOT XRB project.

Our NOEMA observations occurred on 2018-03-16, with scans on source from 05:25 to 07:44 UTC (MJD=58193.2257-58193.3222), in the 3mm (97.5 GHz) band. MAXI J1820+070 was significantly detected as a point source, with a preliminary flux density of 30 +/- 3 mJy, measured in the UV-plane (where the uncertainty on the flux density represents a 10% error on the absolute flux scale). Adverse weather conditions prevented us from obtaining observations of MAXI J1820+070 in the 2mm (140 GHz) and 1mm (230 GHz) bands.

With these data, we measure the position of the source to be,
 RA(J2000) = 18h20m21.94 +/- 0.001s (0.02")
 DEC(J2000) = +07d11'07.24 +/- 0.06"

This position lies within the X-ray error circle (1.33 arcsec separation; ATel #[11406](#)), and is consistent with the reported optical position (0.05 arcsec separation from a star in archival Gaia DR1 data; ATel #[11424](#), and 0.6 arcsec separation from ASASSN-18ey; ATel #[11400](#)).

Sub-mm detections of black hole X-ray binaries typically arise from a compact synchrotron-emitting jet in the hard state, characterized by a flat to slightly inverted, optically thick spectrum ($S_{\nu} \propto \nu^{\alpha}$, spectral index $\alpha \geq 0$), originating from overlapping self-absorbed synchrotron contributions from different regions along the jet. Given our sub-mm flux, and the radio flux from a new AMI radio observation (that was taken simultaneously with our NOEMA observations) of 29 +/- 3 mJy, we derive a radio through sub-mm spectral index of 0.02 +/- 0.09 (consistent with the flat radio spectrum reported in ATel #[11439](#)). This AMI flux corresponds to a radio luminosity of (3.32 +/- 0.34)E31*(d/8kpc)^2 erg/s).

Swift/XRT observed MAXI J1820+070 on 2018-03-16 between 03:01:32 and 03:17:56 UTC. We extracted the data using the online XRT pipeline (Evans et al. 2009) and fit with an absorbed

Related

- 12688 [Continued Swift Monitoring of the Galactic Black-Hole Binary MAXI J1820+070](#)
- 12608 [Optical spectroscopy and photometry of MAXI J1820+070 \(ASASSN-18ey\) during the large multi-wavelength re-brightening of March 2019](#)
- 12596 [Optical observations of MAXI J1820+070 confirm the re-brightening](#)
- 12577 [AMI-LA and Swift confirm the multi-wavelength re-brightening of MAXI J1820+070](#)
- 12573 [Swift observation of the re-brightening in MAXI J1820+070](#)
- 12567 [Re-brightening 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 re-brightening 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](#)

power-law model. We find a best fit with an N_H of $(3.0 \pm 0.5)E20 \text{ cm}^{-2}$ and a photon index of 1.50 ± 0.02 , providing an unabsorbed 0.5-10 keV X-ray flux of $(8.96 \pm 0.08)E-9 \text{ erg/s/cm}^2$, corresponding to a 0.5-10 keV X-ray luminosity of $(6.87 \pm 0.15)E37*(d/8\text{kpc})^2 \text{ erg/s}$ (all errors are 1-sigma). The X-ray and radio luminosities reported here are consistent with evidence at other wavelengths that suggest the source is a black hole X-ray binary in the rising hard state (ATel #11427, #11432).

We will continue to monitor the source at sub-mm frequencies.

We thank the IRAM NOEMA staff for rapidly scheduling our observations and the AMI scheduling team for their continued monitoring of the source.

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- 11855 Polarimetric monitoring of the MAXI J1820+070 in optical and near-infrared wavelengths
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