Simultaneous LOFAR and AMI-LA observations of MAXI J1820+070

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Simultaneous LOFAR and AMI-LA observations of MAXI J1820+070

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We report on the detection of MAXI J1820+070 (e.g. ATel #11399, #11418, #11420) with the Low-Frequency Array (LOFAR). Observations in the high band (115-189 MHz) were carried out from 2018 April 27 02:32:33.0-04:32:33.0 UTC (MJD 58235.106-58235.189). Using data from 115-166 MHz and the Prefactor calibration pipeline (e.g. van Weeren et al. 2016, ApJS, 223, 2), we generated a preliminary map with angular resolution 34.5" x 20.3" (beam position angle 33.2 deg). We detect an unresolved point source at the fitted position RA 18:20:21.9, Dec. +07:11:07, after initial first-order corrections for potential systematics in the astrometry. Moreover, the preliminary 140-MHz flux density is 42 +/- 5 mJy, determined with the MIRIAD task IMFIT; the fitting error and an estimated 10 per cent calibration error were combined in quadrature to obtain the overall uncertainty. The flux density scale is that of Scaife & Heald 2012 (MNRAS, 423, L30). Our LOFAR flux density further constrains the shape of the radio spectrum in the metre-wavelength regime, with our measurement being close in value to the VLITE detection at 339 MHz on 2018 April 12 (ATel #11540).

MAXI J1820+070 was also observed by the Arcminute Microkelvin Imager Large Array (AMI-LA), simultaneously with LOFAR, between 2018 April 27 02:07:27.3-05:05:12.5 UTC (MJD 58235.089-58235.212). The observation was performed over a 5-GHz bandwidth (4096 channels), with a central frequency of 15.5 GHz. The data were then binned into 8 broad frequency channels, and flagged and calibrated using the custom reduction pipeline reduce_de (e.g. Perrott et al. 2013, MNRAS, 429, 3330). Additional flagging, and then cleaning, was done in CASA using natural weighting and a gain factor of 0.1. MAXI J1820+070 is clearly detected as an unresolved source in the image at RA 18:20:22, Dec. +07:11:11 (the synthesised beam major and minor axes are 60" and 30", respectively, with a beam position angle of 10.2 deg), with a flux density of 50 +/- 2 mJy determined using the CASA task IMFIT. The uncertainty includes the statistical fitting error and a 5 per cent calibration error.

The instantaneous two-point spectral index, alpha, between 140 MHz and 15.5 GHz is therefore 0.04 +/- 0.03 (flux density S_nu proportional to nu^alpha), a value that is consistent with previous reports of a near-flat radio spectrum (e.g. ATel #11439, #11539).
We thank the ASTRON Radio Observatory for promptly scheduling our LOFAR observations and pre-processing the data. We also thank the MRAO staff for carrying out the AMI-LA observations.
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