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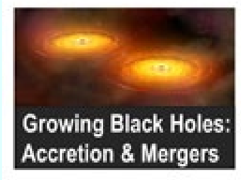

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ATCA radio detection of the new X-ray transient MAXI J1631-478

ATel #12396; ***T. D. Russell, J. van den Eijnden & N. Degenaar (UvA)***
*on **16 Jan 2019; 09:33 UT***
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Subjects: Radio, Black Hole, Neutron Star, Transient

Referred to by ATel #: 12418, 12421, 12438, 12504

We conducted DDT radio observations of the new X-ray transient MAXI J1631-479 (ATels #12320, #12340), using the Australia Telescope Compact Array (ATCA). Our observations occurred on 2019 January 13 between 17:21 and 20:48 UT (MJD 58496.79 +/- 0.07), with the telescope in a 1.5 km configuration (1.5D). Our observations were taken simultaneously at central frequencies of 5.5 and 9 GHz, with a bandwidth of 2 GHz at each frequency. We used PKS 1934-638 and 1646-50 for flux and phase calibration, respectively. The data were edited, calibrated and imaged following standard routines within CASA (version 4.7.2; McMullin et al. 2007). We imaged using a Briggs robust parameter of 0 to balance sensitivity and resolution, as well as minimise the effects from some minor diffuse emission, particularly at 5.5 GHz. These parameters provided angular resolutions of 4.4"x1.3" at 5.5 GHz and 3.2"x0.9" at 9 GHz, with position angles of 131 and 133 degrees North of East, respectively.

The radio counterpart to MAXI J1631-478 was significantly detected, consistent with the reported NuSTAR position (ATel #12340). Fitting for a point source in the image plane, we measure a (9 GHz) position of:
RA (J2000): 16:31:14.22 +/- 0.06,
Dec (J2000): -47:48:23.44 +/- 0.06,
where the 1-sigma errors are the uncertainties on the fitted position.

We measure flux densities of 630 +/- 50 uJy at 5.5 GHz and 610 +/- 20 uJy at 9 GHz, implying a radio spectral index of α= -0.07 +/- 0.20, where $S_\nu \propto \nu^\alpha$. Given this spectral index, the radio emission converts to a 5-GHz luminosity of (9.5 +/- 0.8)E28*(d/5 kpc)^2 erg/s. While our measured radio spectral index is consistent with a flat spectrum from a compact jet, it may also be a steeper spectrum originating from an optically-thin radio flare.

Related

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12418 INTEGRAL detection of the new transient MAXI J1631-479
12396 ATCA radio detection of the new X-ray transient MAXI J1631-478
12340 MAXI J1631-479 is a new X-ray transient
12320 MAXI/GSC detection of a bright hard X-ray outburst probably from AX J1631.9-4752

As MAXI J1631-478 was in Sun constraint for Swift and NICER, we used MAXI monitoring to estimate the X-ray flux and place the source on the radio/X-ray diagram. On 2019 January 13 (MJD 58496), the daily MAXI count rate (2-20 keV) equaled 3.37 +/- 0.04 cts/s or approximately 1.05 Crab units. Assuming a Crab spectrum, this corresponds to a 2-10 keV flux of ~2.5E-8 erg/s/cm^2 and a luminosity of ~7.5E37 (d/5 kpc)^2 erg/s.

Combining the ATCA radio and MAXI X-ray luminosities, MAXI J1631-478 appears most consistent with a hard state neutron star LMXB for distances closer than 5 kpc. For larger distances, it is not consistent with known accreting neutron stars or black holes (Gallo et al. 2018). However, the radio/X-ray correlation would not apply if we are, in fact, detecting an optically-thin radio flare, in which case a soft-state black hole LMXB would also be plausible. Therefore, at present, our radio observations do not conclusively discriminate between a neutron star or black hole LMXB.

Further ATCA radio monitoring is planned, which may give more insight into the nature of the compact accretor. Multi-wavelength monitoring is encouraged.

We thank Jamie Stevens and ATNF staff for scheduling the radio observations.

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