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ATCA radio detection of the new X-ray transient IGR J17591-2342 suggests a black hole candidate

ATel #11954; *T. Russell, N. Degenaar, R. Wijnands and J. van den Eijnden (University of Amsterdam)*

on 15 Aug 2018; 08:52 UT

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Subjects: Radio, X-ray, Black Hole, Transient

Referred to by ATel #: [11957](#), [11970](#), [12004](#)

Following the recent report of the new X-ray transient IGR J17591-2342 (Atels #[11941](#), #[11942](#), #[11946](#)), we conducted DDT radio observations with the Australia Telescope Compact Array (ATCA).

We observed IGR J17591-2342 on 2018 August 14 between 10:38 UT and 16:23 UT (MJD 58344.56 +/- 0.12). The radio observations were taken simultaneously at central frequencies of 5.5 and 9.0 GHz, with 2 GHz of bandwidth at each frequency. PKS 1934-638 and 1817-254 were used for flux and phase calibration, respectively. The data were reduced and imaged following standard procedures in CASA (v4.7; McMullin et al. 2007). Imaging was carried out with a Briggs robust parameter of 0 to both balance sensitivity with resolution, as well as minimise the effects from diffuse emission and other bright sources in the field. With the telescope in a hybrid 1.5D configuration due to a current reconfiguration, these choices provided angular resolutions of 6.8"x1.4" at 5.5 GHz and 3.9"x0.9" at 9 GHz (with a position angle 15 degrees North of East).

We significantly detected the radio counterpart to IGR J17591-2342 at a position coincident with the reported X-ray position (ATel #[11942](#)). We measure a 9.0 GHz radio position of:

RA (J2000) = 17:59:02.86 +/- 0.04, Dec (J2000) = -23:43:08.3 +/- 0.1,

where the errors are the uncertainties on the fitted position, which are larger than the theoretical statistical error of centroiding ($\text{Beam}/2 \cdot \text{SNR}$).

Fitting for a point source in the image plane, we measure a flux density of 1.09 +/- 0.02 mJy at 5.5 GHz and 1.14 +/- 0.02 mJy at 9.0 GHz. The results give a radio spectral index, α , of 0.1 +/- 0.3, where $S_\nu \propto \nu^\alpha$, suggesting a flat spectrum from a compact radio jet. This spectral index implies a 5-GHz radio luminosity of $(4.7 \pm 0.2) E_{29} (d/8\text{kpc})^2 \text{ erg/s}$.

Swift/XRT observed IGR J17591-2342 on the same day as our radio observation (snapshots were taken either side of the radio observation on 2018 August 14 between 00:37:01-00:43:57 UT and 16:27:02-16:33:58 UT; obs ID: 0001084002). We extracted the data using the online XRT

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pipeline (Evans et al. 2009) and fitted it with an absorbed power-law model. We find a best fit with $n_{\text{H}} = (4.4 \pm 0.8)E22 \text{ cm}^{-2}$ and a photon index, Γ , of 1.6 ± 0.3 , with an unabsorbed 0.5-10 keV X-ray flux of $(3.4 \pm 1.5)E-10 \text{ erg/s/cm}^2$, similar to previously reported results (ATel #11942), albeit at a marginally lower X-ray flux, indicating the source has faded slightly. This flux implies an 0.5-10 keV luminosity of $(3 \pm 1)E36*(d/8\text{kpc})^2 \text{ erg/s}$.

Comparing the determined radio and X-ray luminosities to those of typical hard state X-ray binaries, our results imply that IGR J17591-2342 is consistent with a black hole low-mass X-ray binary, most likely on the radio bright track.

We thank Jamie Stevens and the ATNF staff for making these ATCA observations possible.

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