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VLA radio detection of the very-faint X-ray transient IGR J17379-3747

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on 28 Mar 2018; 18:36 UT

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Subjects: Radio, X-ray, Binary, Neutron Star, Transient

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IGR J17379-3747 is a neutron star low-mass X-ray binary showing Type I bursts (Chelovekov et al. 2006, *AstL*, 32, 456; see Chelovekov & Grebenev 2010, *AstL*, 36, 895 for a correction to the positions reported in the earlier paper). It experienced two outbursts in the past (2004 and 2008; Chelovekov & Grebenev 2010) that did not exceed a peak luminosity of $\sim 1E+36$ erg/s, classifying it as a very-faint X-ray transient (Wijnands et al. 2006, *A&A*, 449, 1117). MAXI/GSC reported renewed X-ray activity of this source on March 19, 2018 (Atel #11447). We subsequently triggered our joint X-ray and radio monitoring campaign with the Neil Gehrels Swift Observatory (Swift) and the Karl G. Jansky Very Large Array (VLA).

We observed IGR J17379-3747 with the VLA on March 22, 2018 from 12:11 to 13:54 UT (MJD 58199.543 +/- 0.035). These observations were taken simultaneously at 4.5 and 7.5 GHz, each with a bandwidth of 1 GHz. The VLA was in its most extended A configuration. 3C286 and J1733-373 were used for primary and secondary calibration, respectively. Following standard procedures, we used the Common Astronomy Software Applications package (CASA v4.7.2; McMullin et al. 2017, *ASPC*, 376, 127) to calibrate and image the data. We used Briggs weighting with a robustness of zero to balance sensitivity and resolution.

We determined the flux density by fitting a point source in the image plane, forcing an elliptical Gaussian fit with the size of the synthesized beam (1.1" x 0.3" at 4.5 GHz and 0.69" x 0.18" at 7.5 GHz). We measure flux densities of 431 +/- 7 μ Jy at 4.5 GHz and 422 +/- 7 μ Jy at 7.5 GHz. These measurements provide a spectral index of $\alpha = -0.04 +/- 0.05$ (where the flux density $S_\nu \propto \nu^\alpha$). This spectral index is consistent with a self-absorbed compact jet.

The best fit source position (taken at 7.5 GHz) is:

RA (J2000) = 17h 37m 58.836s +/- 0.002 s

Dec (J2000) = -37d 46' 18.35" +/- 0.02",

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where the errors are calculated using the standard VLA astrometric accuracy of 10% of the synthesized beam. This position is consistent with the enhanced X-ray position measured with the Swift XRT online pipeline (Goad et al. 2007, A&A, 476, 1401) using the two performed monitoring observations of the current outburst (RA: 17h 37m 58.82s, Dec: -37d 46' 18.8", 90% confidence error radius 2.1").

The Swift XRT monitoring observation closest in time to the radio observation was performed on March 23, 2018 from 13:39 to 13:59 UT. We extract the PC-mode spectrum using the Swift XRT online pipeline (Evans et al. 2009, MNRAS, 397, 1177). The spectrum is well described by an absorbed power law model, yielding an absorption column of $N_{\text{H}} = (1.7 \pm 0.3) \times 10^{22} \text{ cm}^{-2}$ and a power law photon index of 2.12 ± 0.16 . The addition of a soft blackbody component does not significantly improve the fit. The unabsorbed 1-10 keV X-ray flux is $(1.76 \pm 0.07) \times 10^{-10} \text{ erg s}^{-1} \text{ cm}^{-2}$.

Assuming the peak flux during its X-ray bursts (Chelovekov et al. 2006, AstL, 32, 456) reached the empirical Eddington limit for a neutron star ($3.8 \times 10^{38} \text{ erg s}^{-1}$; Kuulkers et al. 2003, A&A, 399, 663) places the source at a distance of approximately 8 kpc. For such a distance, the radio and X-ray luminosities are $2.0 \times 10^{29} \text{ erg s}^{-1}$ and $1.3 \times 10^{36} \text{ erg s}^{-1}$, respectively. At this X-ray luminosity, our radio detection is consistent with the brightest sources in the sample of neutron star low-mass X-ray binaries (e.g. Deller et al. 2015, ApJ, 809, 13). Although the radio-brightest neutron star low-mass X-ray binaries include some accreting millisecond X-ray pulsars and transitional millisecond pulsars, we note that other examples of these systems are radio-quieter.

Continuing Swift and VLA monitoring of IGR J17379-3747 is planned. Further multiwavelength observations are encouraged.

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