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VLA radio non-detection of IGR J17379-3747 as the X-ray flux drops

ATel #14061; *N. V. Gusinskaia (University of Toronto), J. W.T. Hessels (ASTRON, University of Amsterdam), A. D. Jaodand (California Institute of Technology), J. C.A. Miller-Jones (Curtin University), N. Degenaar (University of Amsterdam), A. T. Deller (Swinburne University of Technology), T. D. Russell (University of Amsterdam), S. Bogdanov (Columbia University)*

on 3 Oct 2020; 12:45 UT

Credential Certification: [Jason W.T. Hessels \(j.w.t.hessels@uva.nl\)](mailto:j.w.t.hessels@uva.nl)

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

IGR J17379-3747 is an accreting millisecond X-ray pulsar (AMXP). During its previous outburst in 2018, it revealed a few remarkable properties (Bult et al. 2019, ApJ, 877, 70B) that are similar to those of transitional millisecond pulsars (tMSPs) -- binary neutron stars that switch between being active as a radio millisecond pulsar and looking like an AMXP.

Following the SRG/ART-XC report of a new outburst from IGR J17379-3747 on September 29th, 2020 (ATel#14051), we triggered our joint Karl G. Jansky Very Large Array (VLA) and Neil Gehrels Swift Observatory X-ray telescope (Swift-XRT) radio and X-ray monitoring programs, in which we aim to observe known tMSPs and tMSP candidates during their outbursts.

We observed IGR J17379-3747 with VLA on September 30th, 2020 starting at 23:30 UTC. The observation was 1 hr long (with ~35 min on source); the data were recorded at X-band (8-12 GHz) and the VLA was in B-configuration (X-band beam size of ~0.6 arcsec). The data were reduced and imaged using CASA (v.5.4.1; McMullin et al. 2007, ASPC, 376, 127).

No radio emission was detected at the known position of IGR J17379-3747 (reported in ATel#11487). The extracted flux density (~0.2 μ Jy) at the source position is consistent with the RMS noise of the image (~5 μ Jy), thus we set a 3-sigma upper limit of the source 10-GHz flux density of 15.2 μ Jy, which translates into a (8-kpc, 5-GHz, assuming a flat spectrum) radio luminosity of $L_R < 1.3 \times 10^{28}$ erg/s.

Additionally, two Swift-XRT observations were performed that bracket our VLA observation. The first observation (obsid: 00031270035) was performed on September 30th, 2020 at 12:10

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UTC with 500 s exposure time. The second observation (obsid: 00013746001) was performed on October 1st, 2020 at 18:40 UTC with ~1300s exposure time. We derived unabsorbed fluxes of $1.8 \pm 0.3 \times 10^{-11}$ erg/s and $3 \pm 1 \times 10^{-13}$ erg/s for the first and second observations, respectively (using the online XRT product tool, the spectral parameters reported in Bult. et al. 2019 and WebPIMMS). These fluxes correspond to 8-kpc, 1-10 keV X-ray luminosities of $1.4 \pm 0.3 \times 10^{35}$ erg/s and $2 \pm 0.7 \times 10^{33}$ erg/s.

Assuming a steady decay of flux between the two Swift-XRT observations, the X-ray luminosity at the time of our VLA observation can be interpolated to be 4×10^{34} erg/s. This puts our new VLA/Swift-XRT measurement in the radio/X-ray luminosity plane fainter in radio than black-hole low-mass X-ray binaries and consistent with radio measurements of other neutron star X-ray binaries.

Our Swift-XRT observations, combined with SRG/ART-XC (ATel#14051) and NICER (ATel#14056) measurements, show that the source has been fading for the last 2.5 days. During its 2018 outburst, IGR J17379-3747 experienced a few significant re-brightenings after fading from the peak of the outburst. Similarly, the most recent Swift-XRT observation (obsid: 00013746002) indicates that the source's flux is rising again. Thus, we will likely continue Swift-XRT and VLA monitoring of IGR J17379-3747. Further multiwavelength observations are encouraged.

We thank Tony Perrault, and the VLA and Swift-XRT staff, for making these VLA and Swift-XRT observations possible.

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rrutledge@astronomerstelegam.org

Derek Fox, Editor

dfox@astronomerstelegam.org