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VLA radio detection of the new X-ray transient SRGt J071522.1-191609

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on 8 May 2020; 14:03 UT

Credential Certification: *Jakob Van den Eijnden (a.j.vandeneijnden@uva.nl)*

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

Referred to by ATel #: [13717](#), [13718](#)

Following the eROSITA discovery of the new X-ray transient SRGt J071522.1-191609 (ATel #13657) and the first follow-up observation using the X-ray telescope (XRT) on board the Neil Gehrels Swift Observatory (ATel #13661), we triggered an X-ray and radio monitoring program using Swift/XRT and the Karl G. Jansky Very Large Array (VLA).

The VLA performed an initial observation of SRGt J071522.1-191609 on 27 April 2020 22:09 UT to 28 April 2020 00:08 UT, while the array was in its C configuration. We observed in 8-bit mode, with two sub-bands centred at 4.5 and 7.5 GHz with 1 GHz bandwidth each. For primary and secondary calibration, we used 3C48 (0137+331) and the nearby calibrator J0725-1904, respectively. We then used the Common Astronomy Software Applications package (CASA) version 4.7.2 (McMullin et al. 2007, ASPC, 376, 127) to analyse the data. We imaged Stokes I using a Briggs weighting scheme, setting the robust parameter to 0 to balance sensitivity and minimise the effects from a brighter background radio source 5.56' away.

SRGt J071522.1-191609 is clearly detected at both 4.5 and 7.5 GHz. To measure its flux density, we applied the imfit-task in CASA to fit an elliptical Gaussian in the image plane, using the FWHM and angle of the synthesized beam (4.2" x 1.9", and position angle -8.3 degrees East of North at 7.5 GHz). We measure flux densities of 193 +/- 22 μ Jy and 176 +/- 7 μ Jy at 4.5 and 7.5 GHz, respectively. The spectral index is $\alpha = -0.18 \pm 0.25$ (where the flux density $S_\nu \propto \nu^\alpha$). This is consistent with a flat radio spectrum from a self-absorbed, compact jet launched by an X-ray binary or, potentially, a steep spectrum ($\alpha \sim -0.7$) typical of jet ejecta.

The radio position of SRGt J071522.1-191609 at 7.5 GHz is:

RA (J2000) = 07h 15m 21.88s +/- 0.01s

Dec (J2000) = -19d 16' 05.0" +/- 0.4",

The positional accuracy is limited by standard VLA systematics at 10% of the synthesized beam. The radio position (1.4" from the Swift/XRT position reported in ATel #13661) is within the

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Swift/XRT 90%-confidence region and consistent with the optical counterpart suggested in ATels #13663 and #13669.

Swift/XRT observed SRGt J071522.1-191609 on 28 April 2020 for 1 ks between 09:28 and 09:46 UT (ObsID 13484002). We used the online XRT pipeline (<https://www.swift.ac.uk>; Evans et al. 2009, MNRAS, 397, 1177) to extract the PC-mode X-ray spectrum. Fitting an absorbed power law model using C-statistics with XSPEC v12.10.1 (Arnaud 1996, ASPC, 101, 17), we find a hydrogen column density of $N_H = (1.2 \pm 0.3)E+22 \text{ cm}^{-2}$ and a power law index of $\Gamma = 1.91 \pm 0.25$, both consistent with the values reported for the first XRT observation in ATel #13661. We measure an unabsorbed X-ray flux of $(2.0 \pm 0.3)E-11 \text{ erg s}^{-1} \text{ cm}^{-2}$ ($(1.15 \pm 0.15)E-11 \text{ erg s}^{-1} \text{ cm}^{-2}$) in the 0.5-10 keV (2-10 keV) band.

The quasi-simultaneous radio and X-ray measurements correspond to 5-GHz and 0.5-10 keV luminosities of $L_R = 5.7E+28 (D/7 \text{ kpc})^2 \text{ erg s}^{-1}$ and $L_X = 1.1E+35 (D/7 \text{ kpc})^2 \text{ erg s}^{-1}$, respectively. These luminosities support an X-ray binary nature of SRGt J071522.1-191609; the source is a very faint X-ray transient candidate (i.e. peak X-ray luminosity below $1E+36 \text{ erg s}^{-1}$) for source distances nearer than $\sim 20 \text{ kpc}$. Depending on the distance, the radio and X-ray luminosities are consistent with both the observed sample of black hole X-ray binaries and the radio-brightest neutron star X-ray binaries (e.g. Bahramian et al. 2018; https://github.com/bersavosh/XRB-LrLx_pub).

We thank the Swift and VLA observatories for rapidly scheduling and performing these observations. Further X-ray and radio monitoring is ongoing, and we encourage multi-wavelength follow-up observations.

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