Radio detection of the 2023 outburst of Be/X-ray binary Swift J0243.6+6124

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*on **28 Jun 2023; 15:07 UT***
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The Be/X-ray binary system Swift J0243.6+6124 hosts a 9.8-second period neutron star. During the source's discovery outburst in 2017, it became the first Be/X-ray binary with detected radio jet emission (ATel #10946). Over the past few months, Swift J0243.6+6124 has been X-ray active again. It initially showed low-level activity in April (ATel #15983, ATel #15984, ATel #15987). At that time, it did not continue into a bright outburst, instead dropping over a few weeks. However, the Swift/BAT detected considerable brightening of the source on 7 June 2023 (ATel #16076), reaching approximately 0.5 Crab in 2-20 keV MAXI monitoring, and indicating a new outburst.

We observed Swift J0243.6+6124 with the Karl G. Jansky Very Large Array (VLA) at 6 and 10 GHz between 23 June 2023 08:35 - 10:05 UTC, while the array was in BnA -> A configuration. We used 3C48 and J0244+6228 as primary and secondary calibrators, respectively. We performed a preliminary analysis using standard routines in CASA v6.4.1 to calibrate and image the 10 GHz band, using Briggs weighting with a robustness of one to balance sensitivity and resolution.

We detected the radio counterpart of the Be/X-ray binary at a 10 GHz flux density of 31.0

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The outburst detected by

+/- 5.0 μJy, where the uncertainty is measured as the rms of a close-by source-free region. Its centroid position is located 0.071" from the Gaia position of the source. At the positional accuracy of the VLA observations, given by one tenth of the beam size of 1.04"x0.26", both positions are consistent.

Swift observed the source the day before our VLA observation (22 June 2023; ObsID 10336043). We used Xspec to fit the spectrum extracted via the online XRT products pipeline with an absorbed black body plus power law model (N_H ~ 2.2e22 cm^-2), and measure an absorbed 0.5-10 keV flux of 1.3e-8 erg/s/cm^2. For a distance of 5 kpc (allowing for a comparison with the 2017/2018 outburst monitoring), the radio and X-ray flux (density) measurements correspond to L_R = 5.6e27 erg/s and L_X = 4e37 erg/s. At similar X-ray luminosities during the 2017 outburst rise, no radio emission was detected, with a slightly deeper radio limit (ATel #10886). During the outburst's decay, however, radio emission was detected at comparable X-ray luminosity (Van den Eijnden et al. 2019, MNRAS, 483, 4628).

We thank the VLA observatory staff for rapidly scheduling the observation. We will continue to monitor the current outburst at radio wavelengths. Multi-wavelength follow-up of this outburst is encouraged.

10813 MAXI/GSC (ATel. 10803) was not from LS I +61 303 but from the new X-ray transient Swift J0243.6+6124

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