VLA radio detection of the black hole candidate X-ray binary EXO 1846-031

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Publication date
2019
Document Version
Final published version
Published in
The astronomer's telegram

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10 Mar 2020; 11:34 UT

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VLA radio detection of the black hole candidate X-ray binary EXO 1846-031

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*on **1 Aug 2019; 18:44 UT***
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Subjects: Radio, X-ray, Black Hole, Transient

Referred to by ATel #: 12991, 12992, 13012, 13036, 13037, 13255, 13344

Following the recent detection of a new outburst from the black hole candidate X-ray binary EXO 1846-031 (ATels #12968, #12969) we triggered approved target-of-opportunity radio observations of the source with the Karl G. Jansky Very Large Array (VLA).

We observed EXO 1846-031 on 2019-08-01, with our on-source time extending between 05:00:32 UT and 05:03:30 UT (MJD 58696.210 +/- 0.001). The VLA was in its most extended A configuration. Observations were taken in two basebands, with central frequencies of 5.25 and 7.45 GHz, and 1.024 GHz of bandwidth in each baseband. 3C286 was used for bandpass and flux calibration, while J1832-1035 was used for complex gain calibration. Data were edited and calibrated using the VLA data processing pipeline within the Common Astronomy Software Application (CASA version 5.4.2; McMullin et al. 2007). Imaging was carried out using standard procedures with a Briggs robust parameter of 1.

We detected EXO 1846-031 at flux densities (S_ν) of 2.54 +/- 0.03 mJy at 5.25 GHz, and 2.42 +/- 0.03 mJy at 7.45 GHz, implying a radio spectral index of α = -0.14 +/- 0.07 (where $S_\nu \propto \nu^\alpha$). Fitting for a point source in the image plane, we measure a position (at 7.45 GHz) of:
R.A. (J2000): 18:49:17.0468 +/- 0.0018

Related
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13189 MAXI/GSC discovery of a

Dec. (J2000): -03:03:55.260 +/- 0.035,
where the R.A. and Dec. errors are systematic errors calculated as 10% of the synthesised beam. This suggests that neither UKIDSS J184917.09-030355.9 nor UKIDSS J184916.87-030354.3 are counterparts to this X-ray binary, although the former is only 1.0" away from the radio position.

Our radio observation translates to a 5 GHz radio luminosity of ~9.7E29 $(D/8kpc)^2$ erg s^{-1} ($L_r = 4 \pi d^2 \nu S_\nu$). NICER observations ~15 hours before our radio observation (ATel #12976) show an unabsorbed 1-10 keV X-ray luminosity of ~3.2E37 $(D/8kpc)^2$ erg s^{-1}. While these radio and X-ray observations were only quasi-simultaneous (separated by ~0.6 day), they place EXO 1846-031 at a position on the radio/X-ray plane that is most consistent with the radio-fainter track for black hole X-ray binaries. To be consistent with the brightest radio detections of neutron star X-ray binaries to date, EXO 1846-031 would need to be closer than 3.7 kpc.

We thank the VLA schedulers for rapidly facilitating these observations.

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