VLA observations identify the currently active source in Terzan 5 as the neutron star transient EXO 1745-248

Tremou, E.; Sivakoff, G.; Bahramian, A.; Heinke, C.; Tetarenko, A.; Wijnands, R.; Degenaar, N.; Linares, M.; Miller-Jones, J.; Patruno, A.; Chomiuk, L.; Strader, J.; Altamirano, D.; Maccarone, T.; Sanna, A.

Published in:
The astronomer's telegram

[Previous | Next | ADS]

VLA observations identify the currently active source in Terzan 5 as the neutron star transient EXO 1745-248

ATel #7262; ***E. Tremou (Michigan State), G. Sivakoff, A. Bahramian, C. Heinke, A. Tetarenko (Alberta), R. Wijnands (Amsterdam), N. Degenaar (Cambridge), M. Linares (IAC), J. Miller-Jones (ICRAR-Curtin), A. Patruno (Leiden), L. Chomiuk, J. Strader (Michigan State), D. Altamirano (Southampton), T. Maccarone (Texas Tech), A. Sanna (UniCA)***
*on **20 Mar 2015; 18:19 UT***
Distributed as an Instant Email Notice Transients
Credential Certification: Gregory R Sivakoff (sivakoff@ualberta.ca)

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

Referred to by ATel #: 7430, 7470

Related
7470 Optical identification of the X-ray burster EXO 1745-248 in Terzan 5
7430 A hard-to-soft state transition is going on in neutron star transient EXO 1745-248
7262 VLA observations identify the currently active source in Terzan 5 as the neutron star transient EXO 1745-248
7247 Swift refined location points to the neutron star transient EXO 1745-248 as the source currently active in Terzan 5
7242 Swift/XRT follow up of the X-ray transient in the globular cluster Terzan 5
7240 Swift/BAT detects an outburst from an X-ray transient in the globular cluster Terzan 5

Following the recent detection of a transient outburst in Terzan 5, and initial Swift X-ray follow-up (ATels #7240, #7242, #7247), we triggered radio observations with the VLA to identify and classify the source via its radio emission. VLA observations were taken from 10:14 UT to 10:43 UT on 2015 March 19 (MJD=57100.43639) with the array in its relatively-extended B-configuration using two 2048-MHz basebands centred at 9.0 and 11.0 GHz. The total exposure time on source was 26 min. Compared to existing VLA data, a transient source was detected and was consistent with an unresolved point source down to the beam size of 1.75 x 0.54 arcseconds (at a position angle of 146.6 deg) at 10.0 GHz.

We therefore fit a point source model in the image plane, yielding flux densities of 23+/-5 microJy/beam averaging the two bands together. This corresponds to a radio luminosity ($L_R=\nu L_{\nu}$) of 1.0+/- 0.2 x 1e28 (d/5.9 kpc)^2 erg/s at 10 GHz. The source was well-detected in the lower 9 GHz baseband (flux density 27+/-7 microJy/beam) but only marginally detected in the upper 11 GHz baseband (flux density 16+/-8 microJy/beam). This is consistent with a steep spectral slope, but the uncertainties are extremely large and include a flat spectral slope; our measured spectral index (defined by S_{ν} ν^{α}) is -2.7 +/- 2.8.

The source position in the combined image was
RA (J2000) = 17:48:05.231 +/- 0.008 (267.021794 deg; +/-0.11 arcsec)
DEC (J2000) = -24:46:47.73 +/- 0.14 (-24.779925 deg; +/-0.14 arcsec),
where the errors only indicate the statistical errors from the source fitting procedure. We note that nominal systematic uncertainties are estimated to be of order 10% of the beam size, i.e., 0.18 x 0.05 arcseconds. The source position is within 0.4 arcseconds of the published location of EXO 1745-248 (CXOGlb J174805.2-244647 = CX 3; Heinke et al. 2006), but is 2.5 arcseconds away from the only other close, previously identified faint X-ray source (CXOGb J174805.1-244645 = CX 24; Heinke et al. 206). We therefore confirm the previously suggested identification based on the X-ray location (ATel #7247) that EXO 1745-248 is the currently outbursting source in Terzan 5.

The increasing Swift/BAT flux suggests that the source remains in the hard spectral state, and that the radio emission is therefore likely to arise from compact jets.

On 2015 March 17 17:41 UT, the X-ray luminosity of the source was ~1.6e36 ((d/5.9 kpc)^2; 0.5-10 keV) erg/s, which given the measured spectrum corresponds to ~1e36 ((d/5.9 kpc)^2; 3-9 keV) erg/s. Assuming that the spectrum has not changed since its first detection, we use the Swift BAT count rates (15-50 keV) for the entire globular cluster to estimate the X-ray luminosities at the time of our radio observations to be ~2.4e36 ((d/5.9 kpc)^2; 0.5-10 keV) erg/s and ~1.5e36 ((d/5.9 kpc)^2; 3-9 keV) erg/s. We compare the radio and X-ray luminosity of this source with the two atoll neutron stars with well established tracks in the L_R-L_X "fundamental plane" (e.g., Chomiuk et al. 2013), both of which are less radio-luminous than accreting millisecond X-ray pulsars / transitional millisecond pulsars. The current outburst of EXO 1745-248 is more consistent with the neutron star track of 4U 1728-34 (Migliari et al. 2003) than that of Aql X-1 (Tudose et al. 2009). We note that EXO 1745-248 is (about 2.5 - 3 times) less radio luminous than both known neutron star tracks; however, given the non-simultaneous nature of our radio and X-ray measurements, further observations are needed to compare these sources.

We strongly encourage simultaneous multi-wavelength observations at all frequencies.

We thank the NRAO staff for rapid scheduling of these VLA observations.

[**Telegram Index**]