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Outburst from low-mass X-ray binary GRS 1747-312 in Terzan 6

ATel #9072; *A. Bahramian, C. O. Heinke, G. R. Sivakoff (Alberta), J. A. Kennea (PSU), R. Wijnands (Amsterdam), D. Altamirano (Southampton)*

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Credential Certification: *Arash Bahramian (bahramia@ualberta.ca)*

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GRS 1747-312 is an eclipsing transient low-mass X-ray binary in the core of the globular cluster Terzan 6. This source shows regular outbursts ~ every 6 months and, due to its eclipsing behaviour, has an accurately-constrained orbital period (12.36 hrs, in't Zand et al. 2003, A&A, 406, 233).

Recently, MAXI reported an outburst from the direction of GRS 1747-312 (<http://maxi.riken.jp/alert/novae/7521375726/7521375726.htm>). Since globular clusters with high stellar encounter rates like Terzan 6 (e.g., Terzan 5, NGC 6440, 47 Tuc, M62), tend to have a high population of X-ray binaries, some even containing multiple transient X-ray binaries (e.g. Atels #2139,#2974,#4242), the MAXI data could not definitively associate this outburst with GRS 1747-312. Thus, in globular clusters either sub-arcsecond angular resolution data (for astrometric identification) or higher sensitivity timing data (for identification through its variability signatures, like a periodic oscillation) are needed for associating an outburst with a known source.

To determine if GRS 1747-312 is the source that is in outburst, we observed Terzan 6 with Swift/XRT on 2016-05-19 from 15:26:17 to 15:51:12 UT. This observation was scheduled to coincide with an egress predicted on the well-known eclipse ephemeris and the last observed eclipse timing (ATel #4915). We observe a clear eclipse egress, with midpoint at 15:36:22 (+/- 5 s), and thus confirm the source in outburst is GRS 1747-312. We note that Saji et al. (2016, PASJ, in press.) reported the absence of eclipses during Suzaku observations of an outburst from the direction of GRS 1747-312 in 2009. This suggests that the source that they detected in outburst in 2009 may have been a different (and thereto unknown) transient X-ray binary in the cluster.

In our observation, the post-eclipse source count rate is more than 18 times higher than the rate during the eclipse. We extracted a spectrum from the post-eclipse interval and performed spectral

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analysis. As the source was piled up in this interval, we chose an annular extraction region with inner and outer radii of 8 and 70 arcseconds respectively. Fitting an absorbed power law (tbabs*pegpwlw in XSPEC; abundances from Wilms et al., 2000, ApJ 542, 914; cross sections from Verner et al., 1996, ApJ, 465, 487), we find a reasonable fit (reduced $\chi^2 = 1.0$ for 45 d.o.f), with a hydrogen column density of $2.5(+/-0.5)e22 \text{ cm}^{-2}$, photon index of $1.5+/-0.2$ and an unabsorbed flux value of $3.9(+/-0.4)e-10 \text{ erg/s/cm}^2$ in 0.5-10 keV band. Assuming a distance of 6.8 kpc for Terzan 6 (Harris catalog, 2010), this corresponds to a luminosity of $2.1(+/-0.2)e36 \text{ erg/s}$. Thus the spectrum and luminosity are consistent with accretion in the non-thermal state.

We thank Neil Gehrels and the Swift staff for the rapid scheduling of this strongly time-constrained observation.

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rrutledge@astronomerstelegam.org
dfox@astronomerstelegam.org
mansii@astronomerstelegam.org