Swift and RXTE follow up observations of the transient currently active in the globular cluster Terzan 5

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Referred to by ATel #: 3723, 3729, 3743

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Following the detection of an X-ray outburst in the direction of Terzan 5 (ATEL #3714), we obtained a Swift observation and additional RXTE observations.

The XRT aboard Swift observed Terzan 5 on Oct. 26, 2011 in imaging mode for a total exposure time of 967 s. The source was detected at high count rates causing significant pile-up (the core is saturated), and a bad column intersects the point-spread function. We estimate (aligning a circle by eye with symmetric parts of the PSF) a position of 17:48:05.43, -24:46:47.9 (J2000) with a 1" (1 σ) error. In addition, the Swift XRT has a systematic positional uncertainty of 3.5" (Goad et al. 2007, A&A, 476, 1401).

Two short (< 30 min) RXTE observations were performed at 23:04 UT on Oct 26th and 00:38 UT on Oct. 27th, i.e., at about 17.5 and 19 hrs after the first discovery (ATEL #3714). Within this time span the source brightened from ~8 mCrab to 83 and 90 mCrab (2-16 keV), respectively. During our observations we detect highly significant broad-band noise in the range 0.007-10 Hz with fractional rms amplitudes of 13±1% and 15±1% (2-60 keV), respectively. No thermonuclear X-ray bursts were detected and we find no evidence for quasi-periodic oscillations nor coherent pulsations.

We fit the 3-30 keV RXTE/PCA spectrum assuming N_H=1.2 × 10^{22} cm^{-2}, finding a good fit including diskbb, powerlaw, and gaussian components. The diskbb has kT=2.55±0.08 keV, powerlaw photon index=2.25±0.14, and iron line equivalent width (fixed at 6.5 keV) of 0.39±0.07 keV. The diskbb component contributes the majority, 59±l3%, of the 3-30 keV flux. Replacing the diskbb with a single blackbody produces a worse fit. While adding an additional blackbody component produces a better statistical fit, this drives the

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diskbb temperature to an unreasonably high value.

Our position is consistent with only one source among the quiescent X-ray sources listed in Heinke et al. 2006 (ApJ, 651, 1098), the X-ray burster EXO 1745-248, which was active in 2000 (Heinke et al. 2003, ApJ, 590, 809). It is not consistent with the position of the 11 Hz pulsar IGR J17480-2446. Given this Swift position and the fact that we do not detect any evidence of coherent pulsations at 11 Hz, we conclude that the transient source is most likely not the X-ray pulsar IGR J17480-2446. Although the position is consistent with that of EXO 1745-248 (Markwardt & Swank 2000, IAUC # 7454 ; Wijnands et al. 2005, ApJ, 618, 883), the identification is inconclusive given the size of the Swift error circle in combination with the high number of quiescent X-ray binaries in this globular cluster, and the fact that several X-ray binaries are likely fainter than the detection limits of Chandra in this cluster.

MAXI has reported (T. Mihara, transient alert 2010-Oct-27 09:57:39) a source at the location of Terzan 5 with flux of 0.5 Crab (4-10 keV), appearing at MJD 55858.53 and decaying by MJD 55859.53. We confirm this with the Swift/BAT lightcurve, which in the same time range shows a flare to 0.01 cts $cm^{-2}s^{-1}$. For a 2.5 keV blackbody spectrum at 5.5 kpc, the Swift/BAT count rate corresponds to 1.2×10^{37} ergs s^{-1} (15-30 keV), or 8×10^{37} ergs a^{-1} (0.5-30 keV), consistent with the MAXI result. Given an approximate 30 ks characteristic timescale; its fluence is on the order of 10^{42} erg. Given this flux, timescale, and fluence, we speculate this flare is a superburst on the surface of the binary's neutron star. This superburst occurred before the INTEGRAL observations reported by Atel #3718, and our RXTE observations. This suggests that the superburst may have triggered the current outburst.

We thank the full Swift and RXTE team for their help in promptly scheduling the observations.

(Amsterdam), P. Casella (Southampton), M. Armas-Padilla (Amsterdam), Y. Cavecchi (Amsterdam), N. Degenaar (Amsterdam), D. Russell (Amsterdam), R. Kaur (Amsterdam), M. van der Klis (Amsterdam), N. Rea (CSIC-IEEC), R. Wijnands (Amsterdam)

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