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*an unusual very-faint transient X-ray binary or an outburst from an intermediate-mass black hole*

Wijnands, R. ; Yang, Y.J.; Degenaar, N. ; Altamirano, D.; Tudose, V.; Heinke, C.O.

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## The transient IGR J17361-4441 in the globular cluster NGC 6388: an unusual very-faint transient X-ray binary or an outburst from an intermediate-mass black hole

ATel #3595; *R. Wijnands, Y. J. Yang, N. Degenaar, D. Altamirano (University of Amsterdam), V. Tudose (ASTRON), C. O. Heinke (University of Alberta)*

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Credential Certification: Rudy Wijnands ([rudy@space.mit.edu](mailto:rudy@space.mit.edu))

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Gibaud et al. (2011, ATel #[3565](#)) reported the INTEGRAL discovery of a new transient, IGR J17361-4441, located in the Galactic globular cluster NGC 6388 (Ferrigno et al. 2011, ATel #[3566](#)). Swift/XRT has monitored this source from 16 to 25 August on a nearly daily basis (see ATel #[3566](#) for the first observation). The 0.5-10 keV unabsorbed flux in those observations was roughly constant, typically  $(4-6)e^{-11}$  erg/s/cm<sup>2</sup>, corresponding to a 0.5-10 keV X-ray luminosity of  $(6-9)e^{35}$  erg/s (for a distance of 11.5 kpc), making this source a very-faint X-ray transient (VFXT; see Wijnands et al. 2006, A&A, 449, 1117, for a discussion about VFXTs). The spectrum is very hard, with a photon index of 0.6-1.0 (see also ATel #[3566](#)).

Considering its luminosity and location in a globular cluster, the system is most probably a neutron-star low-mass X-ray binary (NS-LMXB), although the hard X-ray spectrum is atypical for LMXB transients, which normally show indices of 1.6-2.2 in this luminosity range. However, there exist a small sub-group of NS-LMXBs with similarly hard spectra: accreting X-ray pulsars with high magnetic field ( $>1e^{12}$  Gauss) neutron stars (e.g., Her X-1, GRO J1744-28; see Becker et al. 1977, ApJ, 214, 879; Giles et al. 1996, ApJ, 469, L25). Sensitive X-ray observations (e.g., Chandra, XMM-Newton) could detect pulsations with periods above  $\sim 0.1$  second as observed for this class. This would be the first such transient found in a globular cluster.

Alternatively, the source could be an LMXB with an ordinary, low magnetic field ( $<1e^{10}$  Gauss) neutron star. In that case, long observations might detect type-I X-ray bursts and high-sensitivity, high-time resolution observations (e.g., with XMM-Newton) might detect

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pulsations  $> 100$  Hz. This source probably has a rather low time-averaged accretion rate and it such systems often harbor accreting millisecond X-ray pulsars (e.g. Wijnands 2008, AIPC, 1010, 382). Detecting either fast pulsations or type-I X-ray bursts from the system will prove it is an ordinary NS-LMXB, although its enigmatic X-ray spectrum still needs to be explained.

Thirdly, NGC 6388 may harbor an intermediate mass black hole (of  $(6-20)E3$  solar masses, Lanzoni et al. 2007, ApJ, 670, 1065, Lutzgendorf et al. 2011, A&A, 533, 36). This outburst could be an accretion outburst from an intermediate mass black hole, as the X-ray position is currently consistent with the cluster center. A scheduled Chandra observation of this source will determine its position, and may rule out this hypothesis. Alternatively, sensitive radio observations might detect elevated radio emission at a level of a few tens of mJy (using the results of Merloni et al. 2003, MNRAS, 345, 1057; Maccarone 2004, MNRAS, 351, 1049, and the observed X-ray luminosity) which would also provide support for this hypothesis.

Since this VFXT in NGC 6388 is very unusual in its behavior, we strongly urge follow-up observations of this source at all wavelengths to gain more insight in its nature.

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R. E. Rutledge, Editor-in-Chief

[rrutledge@astronomerstelegam.org](mailto:rrutledge@astronomerstelegam.org)

Derek Fox, Editor

[dfox@astronomerstelegam.org](mailto:dfox@astronomerstelegam.org)