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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

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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^2, corresponding to a 0.5-10 keV X-ray luminosity of (6-9)e35 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 (>1e12 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 ~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 (<1e10 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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