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EWASS Symposium (S11), Tenerife, Spain, 22-26 June 2015

Soft, absorbed X-ray spectra of the new transient IGR J17451-3022

ATel #6459; ***C. O. Heinke, A. Bahramian (Alberta), D. Altamirano (Southampton), R. Wijnands (Amsterdam)***
*on **10 Sep 2014; 21:47 UT***
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Subjects: X-ray, Neutron Star, Transient

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We report Swift/XRT followup observations of the new transient IGR J17451-3022 discovered in JEM-X observations performed Aug. 22-24 (Atel #6451). Swift observed with XRT in PC mode on Sept. 5 (1648 seconds; position reported in Atel #6451), Sept. 9 (1950 s, starting at UT 10:00), and on Sept. 10 (856 s, starting at UT 2:12). IGR J17451-3022 is clearly detected in each observation, with moderate pileup.

We extracted source spectra (excluding the central 8-10" to avoid the piled-up region) and background spectra from the 3 XRT PC mode observations, constructed effective area files, and used the appropriate response matrices. We grouped the data to 50 counts/bin in the first two observations, and 25 counts in the third observation, and fit the spectra simultaneously in XSPEC with absorbed (TBABS, using Wilms et al. (2000, ApJ, 542, 914) abundances) power-law, blackbody (bbodyrad), or bremsstrahlung models. An absorbed power-law model gave a poor fit (reduced chi-squared of 1.34 for 59 degrees of freedom), with photon indices greater than 3.3 (best-fit around 3.7). Bremsstrahlung models gave a better fit (reduced chi-squared of 1.16 for 59 dof), but with low temperatures around 2 keV, which seem physically implausible. Fits with a blackbody allowing the absorption, temperature, and radius to vary provided a good fit (reduced chi-squared of 1.16 for 59 dof). In this case, the temperature remains essentially constant at 0.82 (±0.06, at 90% confidence) keV, while the absorption increased ($N_H=5.2\pm0.8 \times 10^{22}$ cm^{-2} on Sept. 5; $7.2\pm1.0 \times 10^{22}$ on Sept. 9; $6.4\pm1.5 \times 10^{22}$ on Sept. 10). The bbodyrad normalization may increase (from 33 to 50, then down to 44), but the variations are not significant. The 2-10 keV unabsorbed flux increases from $1.2(\pm0.1)\times10^{-10}$ ergs cm^{-2} s^{-1} to $1.9(\pm0.2)\times10^{-10}$ ergs cm^{-2} s^{-1}, then to $1.6(\pm0.2)\times10^{-10}$ ergs cm^{-2} s^{-1}. We attempted blackbody fitting with the absorption tied (best-fit at 6×10^{22}). In this case, the temperature varies (from 0.77±0.04, to 0.88±0.05, then to 0.83±0.06), but the fit is markedly poorer (reduced chi-squared of 1.25 for 61 dof).

The nature of IGR J17451-3022 remains unclear. The high absorption is consistent with a location near (or beyond) the Galactic Center. The rather soft spectrum seems to rule out cataclysmic variables and high-mass X-ray binaries, and appears consistent with either a low-mass X-ray binary in the soft state, or perhaps a magnetar. If it is an LMXB located in the Galactic Center, the luminosity (2-10 keV $L_x=1\times10^{36}$ erg/s) would be unusually low for a soft state. This might be explained if the system is nearly edge-on, reducing our visibility of the inner

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disk, which could also explain the varying N_H. Alternatively, the system may be located well beyond the Galactic Center; a distance of 20 kpc would bring the Lx up to 10^{37} ergs/s, reasonable for the soft state. The apparently varying N_H could in this case be due to variations in a more complex spectrum (e.g. a disk blackbody, plus comptonization, and perhaps another blackbody from a neutron star surface) that our limited spectra cannot reasonably constrain. Alternatively, IGR J17451-3022 may be a transient magnetar, in which case we should detect pulsations (in the 2-12 second range) in data of sufficient time resolution.

We thank the Swift team for their rapid scheduling of these observations.

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