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Swift detection of a type-I X-ray burst from Swift J1922.7-1716

ATel #3741; *N. Degenaar, Y. J. Yang, R. Wijnands (University of Amsterdam)*
on 6 Nov 2011; 19:55 UTCredential Certification: *Nathalie Degenaar (degenaar@uva.nl)*

Subjects: X-ray, Binary, Neutron Star, Transient

Referred to by ATel #: [3742](#), [3807](#)

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Barthelmy et al. (2011; GCN #[12522](#)) report a Swift/BAT trigger on the transient X-ray source Swift J1922.7-1716, which is currently in outburst (ATels #[3548](#), #[3567](#) and #[3740](#)). We have investigated the Swift BAT and XRT data to assess the nature of the BAT trigger. The source was detected for about 30 s in the BAT data (see also GCN #[12522](#)) and we summed those data to obtain a BAT spectrum. This averaged spectrum can be fitted with a blackbody model with a temperature of $kT \sim 2.4$ keV, resulting in an averaged bolometric flux of $\sim 6.4E-8$ erg cm⁻² s⁻¹. These properties suggest that the BAT trigger was caused by a thermonuclear burst (i.e., a type-I X-ray burst) from Swift J1922.7-1716. The BAT lightcurve shows a double-peaked structure (see also GCN #[12522](#)), which may be a signature of a photospheric radius expansion phase, although the limited data statistics prohibit a confirmation using spectral analysis. Using a count rate to flux conversion deduced from the fit to average BAT spectrum, we estimate a bolometric peak flux of $\sim 1.1E-7$ erg cm⁻² s⁻¹. Assuming that the peak reached the empirical Eddington limit of He X-ray bursts ($\sim 3.8E38$ erg s⁻¹; Kuulkers et al. 2003, A&A 399, 663), we can constrain the distance towards the source to be $D < 5.4$ kpc.

XRT follow-up observations commenced ~ 136 s after the BAT trigger. The XRT data show a clear decay in count rate in the first ~ 300 s of the observation. The spectrum during this interval can be adequately fitted with a blackbody model that evolves from $kT \sim 0.81 \pm 0.05$ keV in the first 75 s to $kT \sim 0.71 \pm 0.04$ keV in the last 225 s of the decay (for a fixed hydrogen column density of $N_H = 1.8E21$ cm⁻²; see below). These temperatures are consistent with the cooling tail of a type-I X-ray burst, supporting the suggestion that the BAT triggered on a thermonuclear event from Swift J1922.7-1716. The total duration was nearly 8 min, which is unusually long for regular type-I X-ray bursts. The count rate light curve can be described by a power law decay function with

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an index of -2.1 ± 0.2 , or an exponential decay with a decay time of 107 ± 8 s.

Combining the BAT and the XRT data, we estimate a total fluence of $\sim 2 \times 10^{-6}$ erg cm^{-2} , which corresponds to a radiated energy of $\sim 7 \times 10^{39}$ erg for an assumed distance of 5.4 kpc.

After the initial decay of ~ 300 s, the XRT data shows an approximately constant count rate for the remainder of the observation (~ 1.5 ks). The spectrum of this persistent emission can be described by a simple absorbed power-law model with a hydrogen column density of $N_{\text{H}} = (1.8 \pm 0.1) \times 10^{21}$ cm^{-2} and a photon index of 2.0 ± 0.1 . These spectral parameters are consistent with the results obtained for the 2005 outburst of Swift J1922.7-1716 (Falanga et al. 2006, A&A 456, L5), as well as recent reports on the current outburst (ATel #3567). The 2-10 keV unabsorbed flux inferred from our fit is 3.0×10^{-10} erg cm^{-2} s^{-1} , which results in a 2-10 keV luminosity of 1.0×10^{36} erg s^{-1} (assuming $D=5.4$ kpc).

The above presented results strongly suggest that Swift J1922.7-1716 harbors a neutron star that accretes from a low-mass donor, i.e., that the source is a neutron star low-mass X-ray binary. The inferred 2-10 keV outburst luminosity of only $\sim 1.0 \times 10^{36}$ erg s^{-1} classifies the source as a faint X-ray transient (see Wijnands et al. 2006, A&A 449, 1117).

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