The galactic center X-ray transient XMM J174457-2850.3 is a neutron star low-mass X-ray binary

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On 2012 August 11, Swift/BAT triggered on the galactic center X-ray transient XMM J174457-2850.3 (trigger 530588; GCN #13619), which is currently in outburst (ATel #4305). We have analyzed the BAT and XRT data to investigate the nature of this trigger.

The BAT trigger occurred when Swift/XRT was observing the Galactic center and had XMM J174457-2850.3 in field of view. The XRT data was obtained in photon counting (PC) mode and consists of 2 intervals. During the first ~300-s long interval, carried out ~3.5 h before the BAT trigger, the source is detected at an average intensity of ~0.3 counts s-1. A fit to a simple absorbed powerlaw model yields a spectral index of ~1.5 +/- 1.0, and a 2-10 keV unabsorbed flux of ~8E-11 erg cm-2 s-1 (for a fixed hydrogen column density of N_H=7.5E22 cm-2; Degenaar & Wijnands 2010). These values are similar to those obtained for previous (bright) outburst of this source (e.g., Degenaar & Wijnands 2010). The second XRT interval runs from ~60 s prior to the BAT trigger till ~30 s after. The PC data shows a dramatic increase in source intensity that peaks around the time of the BAT trigger. This provides strong evidence that it was indeed XMM J174457-2850.3 that caused the BAT trigger.

The source is visible for ~20 s in the BAT. The averaged spectrum obtained over this interval can be fitted with a blackbody model with a temperature of kT~2.6 keV (fixing N_H=7.5E22 cm-2). Extrapolation of the fit to the 0.01-100 keV energy range results in a estimated bolometric flux of ~4.5E-8 erg cm-2 s-1. Similar results are obtained when fitting the (pile-up corrected) XRT/PC mode spectrum that was obtained during the BAT trigger (see above). These properties suggest that the BAT triggered on a thermonuclear burst from XMM J174457-2850.3 (i.e., a type-I X-ray burst). Assuming that the BAT flux was equal to, or lower than, the empirical Eddington limit of X-ray bursts (3.8E38 erg s-1; Kuulkers et al. 2003), we can constrain the distance towards the source to be <8.4 kpc.

Automated XRT follow-up observations commenced ~75 s after the BAT trigger, and were obtained in windowed timing (WT) mode. The ~500-s exposure shows a continuous decay in count rate from ~35 to 2 counts s-1. The spectra obtained along this decay can be fitted with a blackbody model that evolves from kT~1.5 +/- 0.1 keV in the first 75 s, to kT~1.2 +/- 0.1 keV in the last 285 s of the observation (for N_H=7.5E22 cm-2). These temperatures are consistent with the cooling tail of a type-I X-ray burst.

At the end of the WT observation, XMM J174457-2850.3 is detected at a count rate of ~2 counts s-1. This is a factor ~7 higher than the persistent emission that was measured ~3.5 h before the BAT trigger (see above), and suggests that the X-ray burst was ongoing. The XRT decay can be described by an exponential function that has a decay time of ~225 s, but a powerlaw decay with a slope ~ -1.1 provides a better fit. Extrapolating the powerlaw decay down to the persistent emission level of the source suggests a total burst duration of ~2 h. By adding the integrated fluence along the XRT decay to the fluence in the 20-s BAT interval, we estimate a total radiated energy of ~1E41 erg (for an assumed distance of 8 kpc). The long duration and large energy output classify this event as an intermediately-long thermonuclear X-ray burst (e.g., Falanga et al. 2008).

The above considerations suggest that BAT trigger 530588 was very likely caused by a thermonuclear X-ray burst from XMM J174457-2850.3. This identifies the previously unclassified X-ray transient as a new member of the class of neutron star low-mass X-ray binaries.

We made use of the online XRT data products tool (Evans et al. 2009).

References:

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