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NICER, Swift, and NuSTAR observations of a rapid decay in XTE J1701-462

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NICER, Swift, and NuSTAR observations of a rapid decay in XTE J1701-462

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on 22 Mar 2023; 21:13 UT

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Subjects: X-ray, Neutron Star, Transient

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In September 2022 the neutron-star transient XTE J1701-462 went into its first major outburst since its discovery outburst in 2006/2007 (ATel #15592, #15594, #15605, #15616). NICER has been monitoring the outburst on a regular basis. After a period of solar exclusion, the observations recommenced in late January and since then the NICER 0.5-10 keV count rates steadily decreased. This decay started to accelerate around March 2 (MJD 60005; see outburst light curve link below). By March 16 the count rate had dropped to ~72 cts/s (52 detectors), down from ~325 cts/s two weeks earlier. After March 16 NICER could not observe the source due to poor visibility. However, we managed to observe XTE J1701-462 with Swift (on March 18 and 20; both 2.7 ks) and NuSTAR (on March 19; 22.1 ks) to continue our coverage of the decay.

We fitted the NuSTAR (3.5-70 keV) spectrum together with the two Swift/XRT (0.5-10 keV) spectra, with an absorbed continuum consisting of a power law and a black body. The N_{H} was fixed to $2.98 \times 10^{22} \text{ cm}^{-2}$ (Fridriksson et al. 2011, ApJ, 736, 162) and the power-law index was linked between the three spectra; all other parameters were left free to vary, to allow for changes over time. Cross-calibration was accounted for with a constant. We obtain a power-law index of 1.78 ± 0.02 . For the March 18, 19, and 20 spectra we find black body temperatures of $1.0 (+0.6/-0.3) \text{ keV}$, $0.78 \pm 0.04 \text{ keV}$, and $0.7 (+0.3/-0.5) \text{ keV}$, respectively, and 0.5-10 keV fluxes (absorbed) of 1.2×10^{-10}

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erg/cm²/s, 9.4×10^{-11} erg/cm²/s, and 4.6×10^{-11} erg/cm²/s. The change in flux is mostly due to a drop in the power-law normalization. We note that the NuSTAR spectrum shows an emission line around 6.4 keV with an equivalent width of ~ 50 eV; the signal-to-noise is not high enough to see obvious asymmetries in the line profile.

We converted the observed NuSTAR and Swift fluxes to 0.5-10 keV NICER count rates with XSPEC and added these to the NICER light curve. This reveals that the rapid decay of the source continues. For a distance of 8.8 kpc (Lin et al, 2009, ApJ, 699, 60) the March 20 unabsorbed flux corresponds to a luminosity of 1.1×10^{36} erg/s. Assuming that the decay progresses similarly to that of the previous outburst (Fridriksson et al. 2010, 714, 270), we expect the source to reach quiescence in about a week from now.

NICER will start observing XTE J1701-462 again on March 23 and, together with Swift, will continue to monitor the decay of the source.

We thank Fiona Harrison and the NuSTAR team for performing the requested DDT observation, and Brad Cenko and the Swift team for executing our ToO program.

Outburst light curve of XTE J1701-462

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