The neutron-star low-mass X-ray binary H 1658-298 back in quiescence

Parikh, A.; Wijnands, R.; Bahramian, A.; Degenaar, N.; Heinke, C.

Published in:
The astronomer's telegram

Link to publication

Creative Commons License (see https://creativecommons.org/use-remix/cc-licenses):
Unspecified

Citation for published version (APA):

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: https://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.
The neutron-star low-mass X-ray binary H 1658-298 back in quiescence

ATel #10169; Aastha Parikh, Rudy Wijnands, Arash Bahramian, Nathalie Degenaar, Craig Heinke
on 14 Mar 2017; 13:06 UT
Credential Certification: Rudy Wijnands (rudy@space.mit.edu)

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

The transient and eclipsing neutron-star low-mass X-ray binary H 1658-298 began its most recent outburst in August 2015 as determined using MAXI (ATel #7943) and we continued to monitor the outburst using Swift/XRT (e.g., ATel #7957, #8046). On 2017 February 15, the source was clearly detected at a luminosity of \(L_X \sim 1 \times 10^{36} \text{ erg/s} \) (0.5 - 10 keV; assuming a distance of 10 kpc) but during the subsequent pointing on March 7 the source was not detected in a \(\sim 1.7 \text{ ksec} \) observation. It indicated a count rate upper limit of \(2.1 \times 10^{-3} \text{ c/s} \) (0.5 - 10 keV; the exposure time was corrected by 900 seconds to account for the expected eclipse during the observation; determined using the linear ephemeris of Oosterbroek et al. 2001). This strong drop in flux suggested that the outburst had possibly ceased after \(\sim 1.5 \text{ yr} \).

To confirm that the source truly transitioned into quiescence, we requested 6 ksec of Swift/XRT data, with a 2 ksec observation every day between March 8 and March 10. During each observation the source was not or only marginally detected. We combined the 4 obtained observations (obs ID 00034002072 - 00034002075, March 7 - 10) and the stacked image shows that H 1658-298 was detected, showing the presence of 15 photons within a circular region having a radius 20 arcsec centred on the source. This shows a count rate of \(\sim 2.2 \times 10^{-3} \text{ c/s} \) (0.5 - 10 keV) for the source (having corrected the exposure time for the several eclipses expected to have occurred during our observations). To understand what this implies for the temperature of the accretion-heated neutron star, we extracted a spectrum from the stacked data and fitted it with a neutron star atmosphere model (nstamos; Heinke et al. 2006), with a fixed value of \(N_h = 2.2 \times 10^{21} \text{ cm}^{-2} \) implemented using tbabs. The obtained effective temperature as seen by an observer at infinity is \(96 \pm 10 \text{ eV} \) and we detected an unabsorbed 0.5 - 10 keV flux of \(\sim 1.1 \times 10^{-13} \text{ erg/cm}^2/\text{s} \) resulting in an associated luminosity (for 10 kpc) of \(\sim 1.3 \times 10^{33} \text{ erg/s} \). The last outburst detection of the source was on February 15 and therefore our temperature estimate was obtained at a maximum of \(\sim 20 \text{ d} \) after the end of the outburst. However, it is likely that this quiescent temperature was obtained closer to the end of the outburst since the source had to decay from \(\sim 1 \times 10^{36} \text{ erg/s} \) to \(\sim 1 \times 10^{33} \text{ erg/s} \) during that time span. This effective temperature is consistent with the initial temperature measurement of H 1658-298 \(\sim 40 \text{ d} \) after the end of the 1999 - 2001 outburst (Wijnands et al. 2003).

We have triggered our XMM-Newton observation and will request additional Swift and Chandra observations to study the cooling of the accretion-heated neutron star in quiescence, similar to...
what has been done after its previous outburst (Wijnands et al. 2003, Cackett et al. 2013). Currently the first XMM-Newton observation is scheduled on March 23. More multi-wavelength coverage of the source, especially in optical would aid this study to determine if accretion has indeed ceased and settled into a cold, quiescent disk.

Bahramian, A, et al. 2015, ATel #7957
Bahramian, A, et al. 2015, ATel #8046
Negoro, Å H, et al. 2015, ATel #7943