Lowest-frequency accreting millisecond X-ray pulsar found

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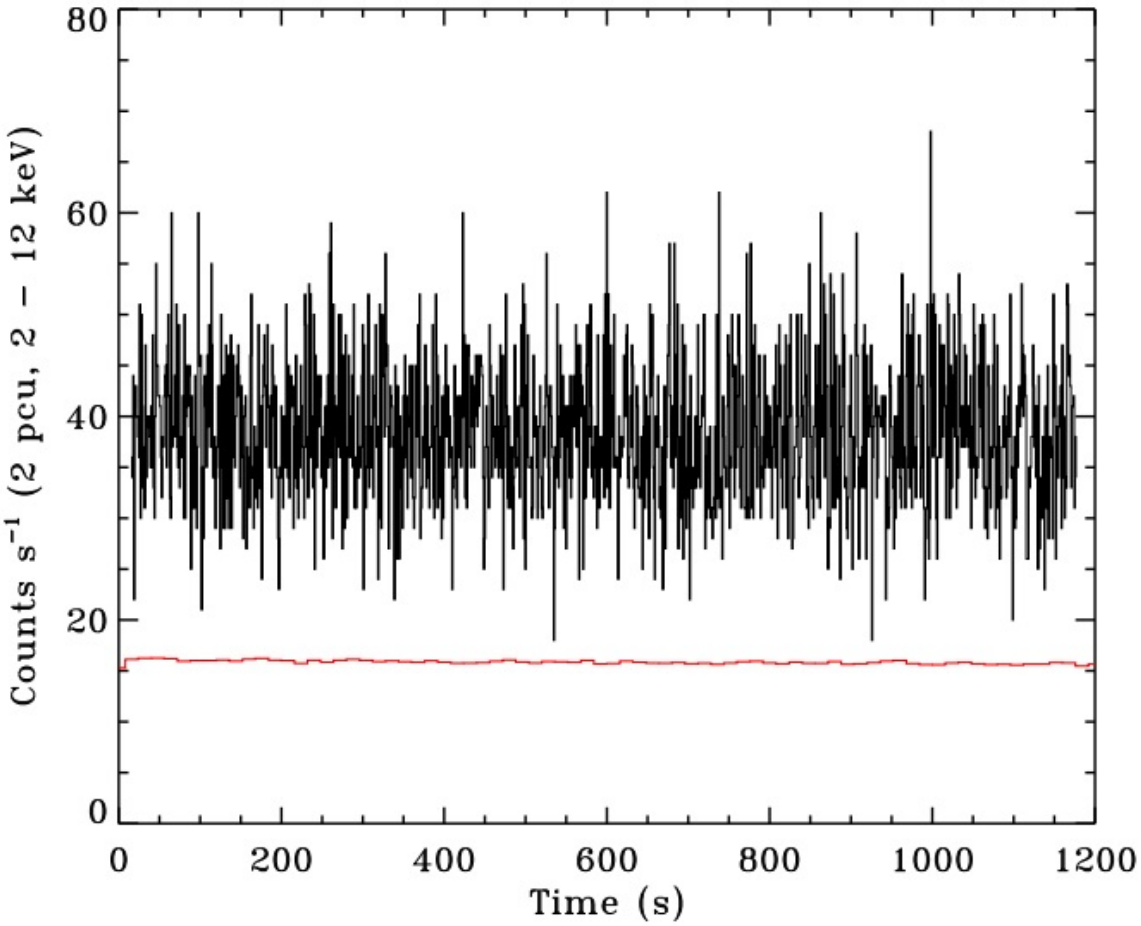

Light curve of IGR J17062−6143 from RXTE PCA observations obtained on 2008 May 3. Data are the summed counting rates in 1 s bins in the 2 - 12 keV band from PCU 0 and 2 (0-4 numbering scheme). The red histogram shows the background estimated from pcabackest. Time zero corresponds to 12:58:39.866 UTC on the above date. Credit: Strohmayer et al., 2017.

(Phys.org)—Astronomers have found the lowest-frequency accreting millisecond X-ray pulsar in the X-ray source known as IGR J17062−6143. By analyzing the data provided by the Rossi X-ray Timing Explorer (RXTE) spacecraft, the researchers detected 163.65 Hz X-ray pulsations from this source. The findings were presented Feb. 17 in a paper published on arXiv.org.

IGR J17062−6143 is an accreting neutron star binary, first observed during an outburst in 2006. Two years later, this object was observed by the RXTE satellite, which acquired important data about its activity.

The data provided by RXTE was recently analyzed by Tod Strohmayer and Laurens Keek of NASA's Goddard Space Flight Center in Greenbelt, Maryland, in order to find pulsations of this source. They extracted light curves, spectra, and an estimate of the background spectrum during the observation. The available data allowed them to gather compelling evidence indicating that IGR J17062−6143 harbors an X-ray pulsar.

"We present the discovery of 163.65 Hz X-ray pulsations from IGR J17062−6143 in the only observation obtained from the source with the Rossi X-ray Timing Explorer," the paper reads.

The pulsations were detected in the 2.0 to 12 keV band. The team searched for pulsations in the frequency range from 10 to 2048 Hz and noticed a strong peak near 163.65 Hz.

The discovery makes IGR J17062−6143 the lowest-frequency accreting millisecond X-ray pulsar known to date. All other accreting millisecond X-ray pulsars have spin frequency over 182 Hz.

Moreover, the researchers found that the pulse frequency varies with time in a manner consistent with orbital motion of the neutron star. This conclusion was drawn after dynamic power spectra were computed in order to determine if any secular variations in the pulsation frequency could be produced by orbital motion of the neutron star.

The team also tried to determine the orbital period of IGR J17062−6143. However, due to the short observation interval, they were not able to precisely calculate it, but only estimated that it should be no shorter than 17 minutes.

"We can find acceptable circular orbits with periods longward of about 20 minutes, however, periods shorter than this are disfavored, and we determined a 90 percent confidence lower limit on the orbital period of 17 minutes," the researchers wrote in the paper.

Determining the orbital period of this pulsar could be essential for understanding more clearly its accretion geometry. It could also help reveal the composition of the accreted material. That is why the team calls for further studies of the orbital period of IGR J17062−6143.

"As we have described, the RXTE/PCA observation was too short to accurately determine the orbital period; therefore, future timing observations are needed, for example, with the Neutron Star Interior Composition Explorer (NICER) which is scheduled for launch in 2017," the scientists concluded.

NICER is planned to be attached to the International Space Station, where it will carry out rotation-resolved spectroscopy of the thermal and non-thermal emissions of neutron stars in the soft (0.2 to 12 keV) X-ray band with unprecedented sensitivity.

More information: IGR J17062-6143 is an Accreting Millisecond X-

ray Pulsar, arXiv:1702.05449 [astro-ph.HE] arxiv.org/abs/1702.05449

Abstract

We present the discovery of 163.65 Hz X-ray pulsations from IGR J17062-6143 in the only observation obtained from the source with the Rossi X-ray Timing Explorer. This detection makes IGR J17062-6143 the lowest-frequency accreting millisecond X-ray pulsar presently known. The pulsations are detected in the 2 - 12 keV band with an overall significance of 4.3 sigma, and an observed pulsed amplitude of 5.54 +- 0.67 % (in this band). Both dynamic power spectral and coherent phase timing analysis indicate that the pulsation frequency is decreasing during the 1.2 ks observation in a manner consistent with orbital motion of the neutron star. Because the observation interval is short, we cannot precisely measure the orbital period; however, periods shorter than 17 minutes are excluded at 90 % confidence. For the range of acceptable circular orbits the inferred binary mass function substantially overlaps the observed range for the AMXP population as a whole.