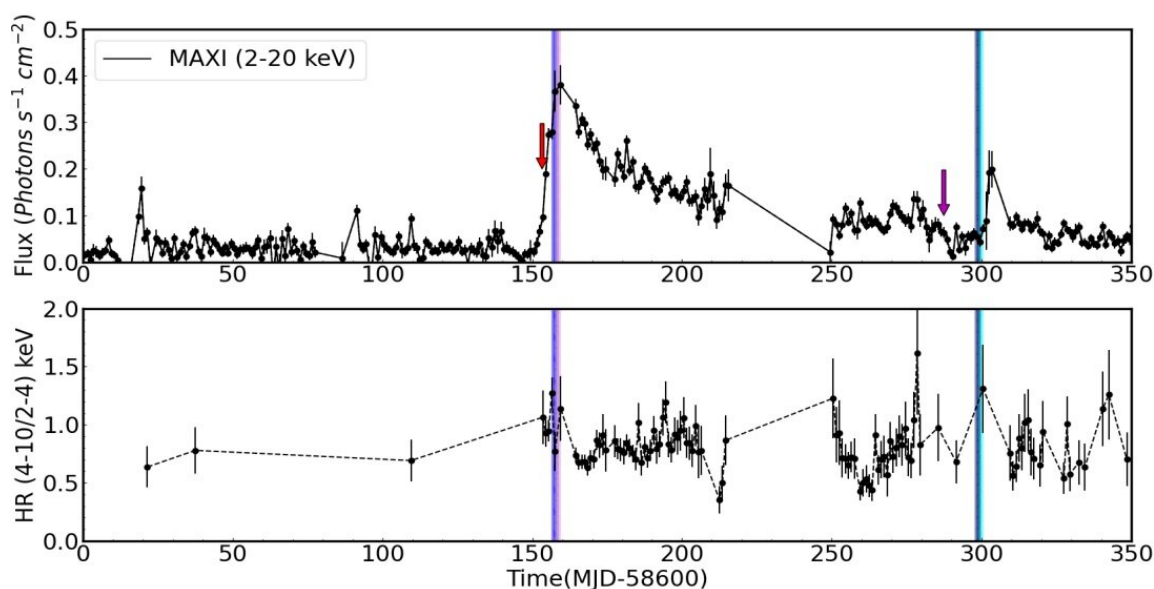


Astronomers observe X-ray binary XTE J1739–285 during recent outbursts

March 30 2023, by Tomasz Nowakowski



The top panel shows the 2–20 keV MAXI/GSC light curve of XTE J1739–285 during its 2019–2020 outburst. The hardness ratio is plotted in the bottom panel. Credit: Beri et al, 2023

Using AstroSat and NuSTAR space telescopes, astronomers have observed an X-ray binary known as XTE J1739–285 during its recent period of bursting activity. Results of the observational campaign,

published March 23 on the *arXiv* pre-print server, yield crucial insights into the behavior of this system.

X-ray binaries (XRBs) consist of a normal star or a white dwarf transferring mass onto a compact neutron star or a black hole. Based on the mass of the companion star, astronomers divide them into low-mass X-ray binaries (LMXB) and high-mass X-ray binaries (HMXB).

Some LMXBs exhibit transient outbursts, during which an increase in X-ray luminosities is observed. When these outbursts are characterized as Type I X-ray bursts—thermonuclear explosions taking place on the surface layers of neutron stars—they obviously confirm the presence of neutron stars in such binaries.

Discovered in 1999 by the Rossi X-ray Timing Explorer (RXTE), XTE J1739–285 is a transient LMXB with a neutron star companion. Since its discovery, the source has experienced dozens of X-ray bursts. More recently, in 2019, it entered a rebrightening phase, during which new X-ray outbursts were identified.

A team of astronomers led by Aru Beri of Indian Institute of Science Education and Research (IISER) Mohali in India, started to observe XTE J1739–285 in October 2019, when the system was in its bursting period. They employed India's AstroSat and NASA's NuSTAR (Nuclear Spectroscopic Telescope Array) spacecraft to perform a detailed timing and spectral study of XTE J1739–285.

"In this paper, we report our results from AstroSat and NuSTAR observations of XTE J1739–285 during its 2019 and 2020 outbursts. We have performed a detailed timing and spectral study of this source," the researchers wrote.

The X-ray light curves during observations of XTE J1739–285

conducted in 2019 by Beri's team indicate the presence of flares. Moreover, the observations identified accretion-powered X-ray pulsations at 386 Hz during very short intervals (from 0.5 to 1 s) of these X-ray flares, which makes XTE J1739–285 an intermittent X-ray pulsar.

AstroSat observations of XTE J1739–285 in 2020 unveiled the presence of a thermonuclear X-ray burst, which led to the detection of coherent burst oscillations at 383 Hz during the burst's decay phase. Therefore, XTE J1739–285 turns out to be one of a few neutron star LMXBs experiencing both nuclear- and accretion-powered pulsations.

The observations also detected a quasi-periodic oscillation (QPO) at 0.83 Hz with root mean square (rms) variability of about 7% during the hard state of XTE J1739–285 in 2020. The [astronomers](#) noted that a similar feature was not found during the soft state of the source, in the preceding year. In addition, the X-ray spectroscopy revealed significant changes in the X-ray spectra of XTE J1739–28 during the 2019 and 2020 outburst.

More information: Aru Beri et al, AstroSat and NuSTAR observations of XTE J1739-285 during the 2019-2020 outburst, *arXiv* (2023). [DOI: 10.48550/arxiv.2303.13085](https://doi.org/10.48550/arxiv.2303.13085)

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