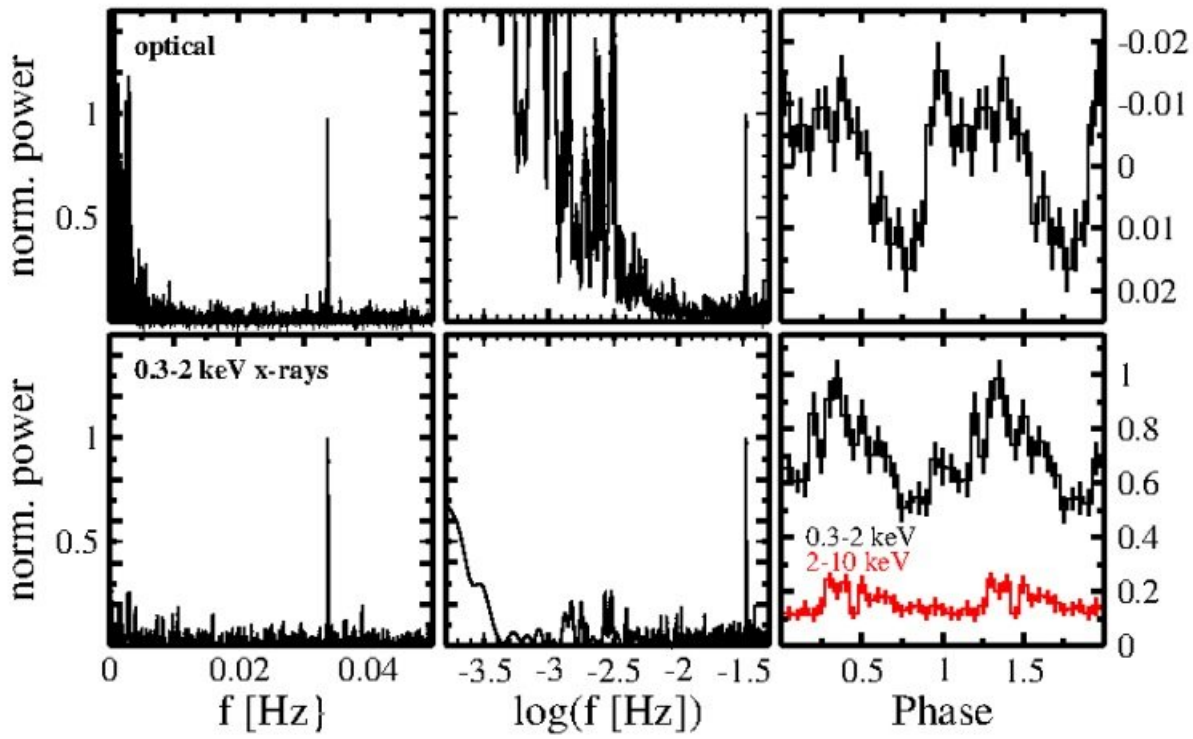
CTCV J2056-3014 is an unusual polar, study finds

August 4 2020, by Tomasz Nowakowski



CTCV J2056-3014: Periodograms and folded light curves on the 29.6 s period from the optical (top) and X-ray (bottom; from pn) data. For X-rays, the periodograms corresponding to the soft band and light curves are shown for the soft and hard bands. Credit: De Oliveira et al., 2020.

Astronomers have investigated a nearby cataclysmic variable system

known as CTCV J2056-3014 using ESA's XMM-Newton satellite. Results of the study, presented in a paper published July 28 on the arXiv pre-print repository, indicate that the object is an unusual accretion-powered, intermediate polar containing an extremely fast-spinning white dwarf.

Cataclysmic variables (CVs) are binary star systems consisting of a white dwarf and a normal star companion. They irregularly increase in brightness by a large factor, then drop back down to a quiescent state. Polars are a subclass of cataclysmic variables, distinguished from other CVs by the presence of a very strong magnetic field in their white dwarfs.

CTCV J2056-3014 is a CV with an orbital period of approximately 1.76 hours at a distance of about 853 light-years from the Earth. Previous studies have suggested that it could be an intermediate polar (IP), for instance, an asynchronously rotating magnetic white dwarf that accretes matter from a Roche-lobe-filling donor star.

A team of astronomers led by Raimundo Lopes de Oliveira decided further test the IP scenario. For this purpose, they have conducted X-ray observations of CTCV J2056-3014 using XMM-Newton's European Photon Imaging Camera (EPIC).

"We have started an XMM-Newton X-ray follow-up program for validation of CV candidates originally identified in optical surveys, which includes CTCV J2056-3014," the astronomers wrote in the paper.

XMM-Newton observations of CTCV J2056-3014 took place in October 2019 and detected a coherent pulsation in X-rays, lasting approximately 29.6 seconds. This pulsation was also reported by previous studies in the optical band, what indicates that it represents the spin of the white dwarf in CTCV J2056-3014. Hence, it means that this system has the fastest-

spinning white dwarf among all the confirmed IPs.

The total luminosity of the system at 0.3-12 keV was measured to be about 0.018 decillion erg/s. This makes it an unusually X-ray-faint IP, as such objects usually have X-ray luminosities at a level of above 1.0 decillion erg/s. Therefore, based on the results, the astronomers classified CTCV J2056-3014 as a low-luminosity intermediate polar (LLIP). Furthermore, no substantial X-ray absorption has been detected in CTCV J2056-3014, which also confirms its LLIP status.

According to the paper CTCV J2056-3014 is entirely accretion-powered and the accretion occurs at a relatively modest rate when compared to other systems of this class. The magnetic field of this system was found to be lower than the values obtained for typical IPs.

The astronomers concluded that the results of their study, together with the relatively short orbital period, make CTCV J2056-3014 an unusual and interesting intermediate polar. They added that the studied system could also be a representative of a currently unrecognized sub-population of the IP class.

More information: CTCV J2056-3014: An X-ray-faint Intermediate Polar Harboring An Extremely Fast-spinning White Dwarf, arXiv:2007.13932 [astro-ph.SR] arxiv.org/abs/2007.13932