Astronomers detect an ultracompact X-ray binary using OGLE

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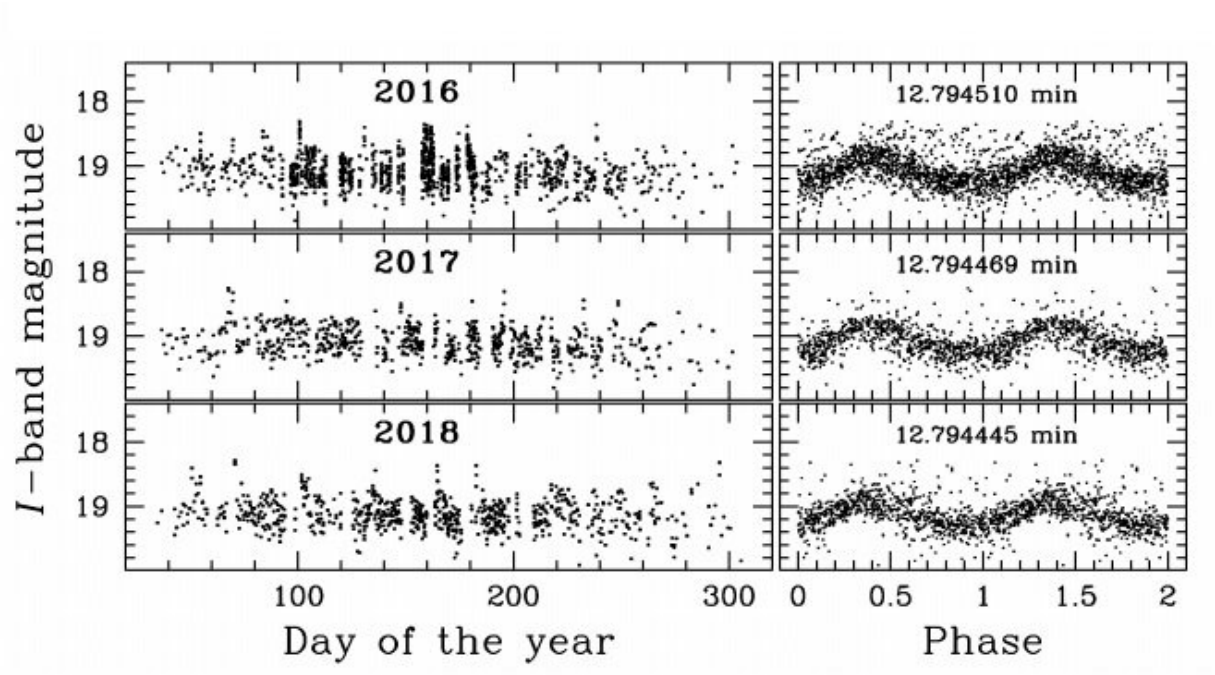

OGLE I-band light curves of the detected variable from seasons 2016–2018 in the time domain (on the left) and phased with a proper period (on the right). The presence of outbursts at such short period points to an ultracompact system. Due to severe blending the real amplitudes of the outbursts and periodic modulation are expected to be much higher. Credit: Pietrukowicz et al., 2019.

Polish astronomers have detected a new ultracompact X-ray binary as part of the Optical Gravitational Lensing Experiment (OGLE). The

newly found binary, designated OGLE-UCXB-01, is an unusual periodic variable object with a relatively short orbital period. The finding is reported in a paper published August 22 on the arXiv pre-print server.

Generally, X-ray binaries are composed 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).

Ultracompact X-ray binaries (UCXBs) are distinguished as a subclass of LMXBs. These systems consist of a white dwarf or helium star losing mass to a neutron star or black hole at a sub-hour orbital period. Given that the evolution and nature of UCXBs are still not well understood, finding new objects of this type is essential for astronomers aiming to advance our knowledge about them.

In a recently published paper, a team of astronomers led by Paweł Pietrukowicz of Warsaw University Observatory in Poland announced the discovery of a new UCXB, probably located in the Milky Way's globular cluster Djorg 2. The finding was made as part of OGLE's long-term variability survey of our galaxy and the Magellanic system. The study was complemented by data from the Hubble Space Telescope (HST) and NASA's Chandra X-ray spacecraft.

According to the research, OGLE-UCXB-01 has an orbital period of approximately 12.79 minutes—the shortest period ever detected in the OGLE data. By analyzing the X-ray emission from this source, the astronomers found evidence for accretion processes taking place in the system. Moreover, the optical data uncovered brightenings lasting several hours, indicative of a small accretion disk around the primary object.

The collected data allowed the researchers to confirm the assumed classification of OGLE-UCXB-01 as a new UCXB. They excluded the possibility that the binary could be a close cataclysmic system of AM CVn type formed of a white dwarf accretor and a degenerate helium-rich donor.

"The presence of frequent, short-duration brightenings at such an ultrashort period in long-term OGLE photometry, together with the blue color of the object in Hubble Space Telescope images and the detection of moderately hard X-rays by Chandra observatory, point to an ultracompact X-ray binary system," the scientists noted.

Furthermore, the observations found that OGLE-UCXB-01 experiences a fast period decrease, suggesting that the system is a strong gravitational wave source in the low-frequency regime. This makes it an excellent target of observations for gravitational wave detectors like ESA's Laser Interferometer Space Antenna (LISA), planned for launch in 2034.

The authors of the paper propose to conduct radial velocity and proper motion measurements of OGLE-UCXB-01 in order to verify whether or not the binary is a member of the Djorg 2 cluster. Moreover, further optical observations could reveal chemical composition of the accreted matter in the system.

More information: P. Pietrukowicz, et al. Discovery of an Outbursting 12.8 Minute Ultracompact X-Ray Binary arXiv:1908.08186v1 [astro-ph.SR]: arxiv.org/abs/1908.08186

https://phys.org/news/2019-08-astronomers-ultracompact-x-ray-binary-ogle.html