

Astronomers find a star with a record variation period

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Robotelescope MASTER II, created by a joint force of the Lomonosov Moscow State University, Sternberg Astronomical Institute (GAISH) scientists, and Moscow Union "Optica". Credit: Lomonosov Moscow State University

Three years ago, Lomonosov Moscow State University astronomers detected a bright star TYC 2505-672-1 that has now faded significantly. The scientists assume that TYC 2505-672-1 is actually a double star system, though the nature of its companion remains unknown. An article about the finding will be published in *Astronomy & Astrophysics*,

and is accessible as a pre-print at *Arxiv*.

The Russian scientists, working with the global MASTER network of robotic telescopes, determined that the giant star in Leo minor, which was considered to be extinct, had in fact just faded—its brightness had decreased by nearly 100 times.

The MASTER telescope network was constructed by MSU scientists under the guidance of Prof. Vladimir Lipunov for the purpose of detecting and researching the most energetic flashes in the Universe, gamma-ray bursts, a process accompanying formations of black holes and neutron [stars](#). They also sought thermonuclear flashes on white dwarfs, galactic center flares and quasars. MASTER telescopes have already detected more than 1000 flashes at distances from several hundred to a billion light years away, as well as a number of potentially dangerous asteroids. The telescopes are located near Blagoveshchensk, Irkutsk, Kislovodsk, in the Ural region, the Moscow region, and also in Argentina, the Republic of South Africa and Spain (on the Canary islands).

Initially, the discovery concerning the star's fading did not seem significant. Phenomena of that kind are known to occur. However, why the star dimmed remained a mystery. Diverse hypotheses were suggested, one of which proposed that a red giant following its evolutionary processes emitted a cloud of stardust consisting of carbon particles and hid itself from view.



Automatic telescope 'MASTER-2' of Irkutsk State University, Tunkin valley.
Credit: Lomonosov Moscow State University

Later photometric measurements by MASTER-Amur and spectral measurements by the 6-metre BTA-6 telescope determined that the star did not turn red as the sun does before sunset as the atmosphere scatters shorter wavelengths of light. For that reason, the star was tracked attentively, and the researchers observed a return of its luminosity. In October 2014, it recovered to normal levels.

At approximately the same time, Rolf Yansen, Dutch astronomer (Arizona university), drew attention to the star. He revised the data of the Harvard observatory picture library, publicly available since June 2014, and detected that from 1942 to 1945, TYC 2505-672-1 underwent

the same decrease in luminosity. According to the scientist's calculations, the star has an unprecedented variation period of 25,245 days, which is about 69 years.

The star became a record-breaker in a length of variation period. According to Denis Denisenko, one of the authors, the previous record belonged to Epsilon Aurigae. Its eclipses repeat over 9890 days, which is a bit more than 27 years. Only five stars are known to have a period of more than ten years. In other words, the new variable star exceeds the existing record by more than two and a half times.

"Ironically, the project MASTER, initially intended for observing fast-occurring phenomena such as gamma-ray bursts and star flashes, discovered an unprecedented variability of a totally different scale," comments Denis Denisenko.

Scientists assume that the star is actually a double system, though they can only speculate on the nature of its companion.

"The scale of the new object is already impressive," says Denis Denisenko. "Giant stars of this spectral class are about three and a half times heavier than the sun. Taking into account the second component, the mass of the system should be around at least four solar masses. The orbital radius of this star should be about 33 astronomical units, and the orbital length should then exceed two hundred astronomical units."

"The system is quite mysterious," Vladimir Lipunov agrees. "We actually see a total eclipse. That means that something totally occults the giant star. Hence, the disc around the second, unseen companion, should be absolutely opaque. But what shines with the same spectrum during the eclipse? That does not seem to be a stardust disc, though, and it can not be another star. If the luminosity of the companion is 100 times lower, then, the companion is a low-mass star. But a low-mass star can not have

a size exceeding that of a more massive companion in that double system, and the eclipse would not take place at all, as you can not hide a larger object behind a smaller one."

More information: Discovery of an unusual bright eclipsing binary with the longest known period: TYC 2505-672-1 / MASTER OT J095310.04+335352.8. arxiv.org/abs/1602.06010

Provided by Lomonosov Moscow State University

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