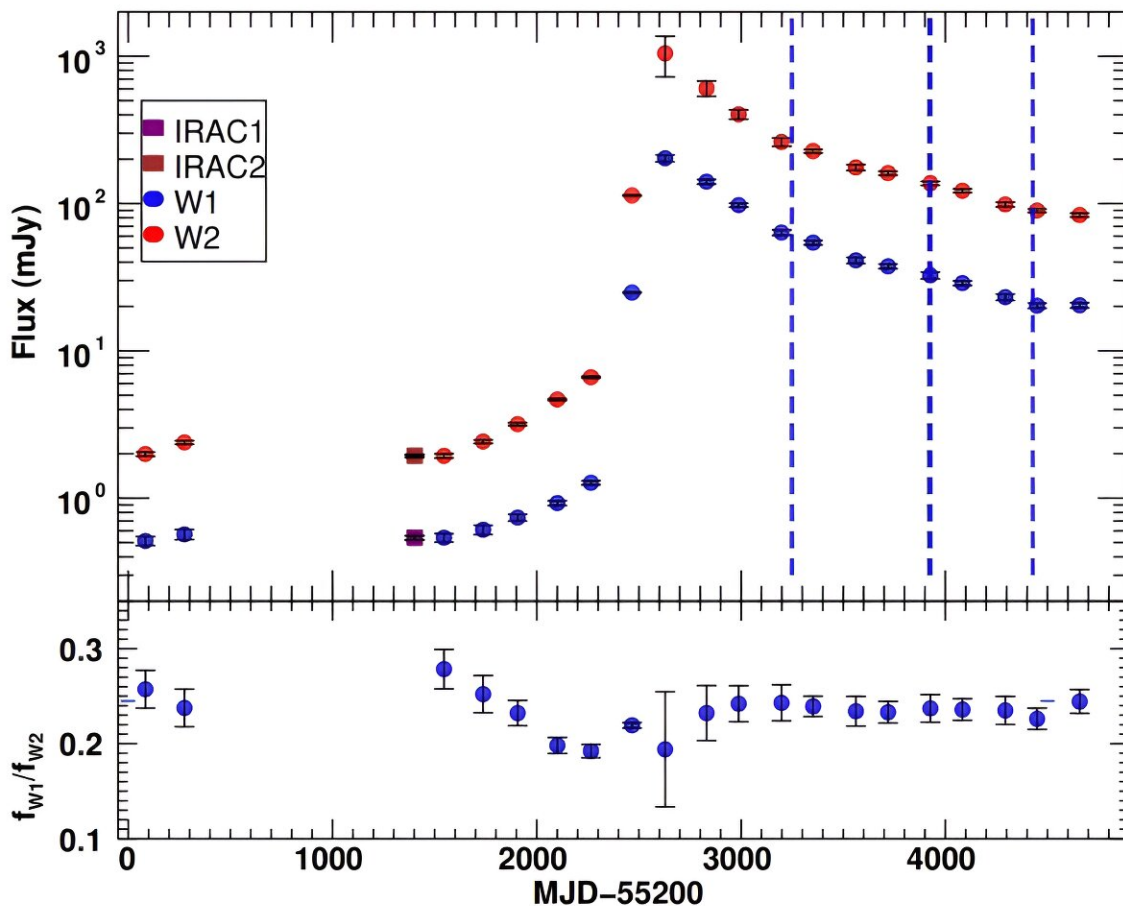


# Giant mid-infrared outburst detected from a distant young stellar object

September 27 2023, by Tomasz Nowakowski



In the upper panel, WISE survey mid-infrared light curves for J064722.95+031644.6 in the W1 and W2 bands. The bottom panel shows the flux ratios between the W1 and W2 bands over the period. Credit: *arXiv* (2023). DOI: 10.48550/arxiv.2309.11016

By conducting a blind search for large amplitude mid-infrared variables in the Wide Infrared Sky Explorer (WISE) archive, Chinese astronomers have serendipitously discovered a giant mid-infrared outburst from a distant young stellar object designated J064722.95+031644.6. The finding is reported in a paper published September 20 on the pre-print server *arXiv*.

Young Stellar Objects (YSOs) are stars in early stages of evolution, in particular, protostars and pre-main sequence stars. They are usually observed embedded in dense molecular clumps, environments containing plenty of molecular gas and [interstellar dust](#).

Given that episodic accretion processes occur in YSOs, these objects may experience accretion-driven outbursts. Astronomers usually divide such events into EX Lup (also known as EXors) and FU Ori outbursts (or FUors). EXors are a few magnitudes in amplitude, and last from a few months to one or two years; FUors are more extreme and rare, can be up to five to six magnitudes in amplitude and last from decades to even centuries.

J064722.95+031644.6 (or J0647 for short) was first identified as an infrared source near a star-forming region in the constellation Monoceros. The true nature of J0647 remained unknown until a new study was conducted by a team of [astronomers](#) led by Tinggui Wang of University of Science and Technology of China in Hefei, China.

Wang's team has recently examined mid-infrared light curves from the W1 and W2 bands of the AllWISE and NEOWISE single-exposure photometric database in the Infrared Science Archive (IRSA) within 6 arcseconds of the ALLWISE position. They found that J0647 is a YSO that exhibited a giant mid-infrared outburst.

"In this paper, we report the serendipitous discovery of a gigantic

eruption in a previously unknown YSO (RA = 06:47:22.95, DEC = +03:16:44.56) in the mid-infrared," the researchers wrote.

According to the study, J0647 is a deeply embedded Class I (possess a disk and envelope) YSO with a quiescent luminosity of about 9.0 solar luminosities. The mass of J0647 is estimated to be between 0.58 and 1.3 [solar masses](#).

The astronomers found that during the mid-infrared [outburst](#), J0647 gradually brightened by a factor of 5 from 2014 to 2016, what was followed by an abrupt rise by a factor of more than 100 in 2017. Therefore, the YSO exhibited a 500-fold increase in mid-infrared brightness over a two-year period, followed by a slow decline. This eruption amplitude is the second largest recorded among all known YSO eruptions in the mid-infrared band.

Based on the light curve alone, the astronomers classified J0647 as an intermediate-type eruption YSO with an exceptional [amplitude](#). They noted that its near-infrared spectrum is different from that of classical FUors, EXors, or many other known intermediate-type outbursts in YSO due to its lack of absorption or emission lines other than diatomic hydrogen (H<sub>2</sub>).

**More information:** Tinggui Wang et al, A Gigantic Mid-Infrared Outburst in an Embedded Class-I Young Stellar Object J064722.95+031644.6, *arXiv* (2023). [DOI: 10.48550/arxiv.2309.11016](https://doi.org/10.48550/arxiv.2309.11016)

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Citation: Giant mid-infrared outburst detected from a distant young stellar object (2023, September 27) retrieved 28 April 2024 from <https://phys.org/news/2023-09-giant-mid-infrared-outburst-distant-young.html>

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