Astronomers detect an outbursting young stellar object

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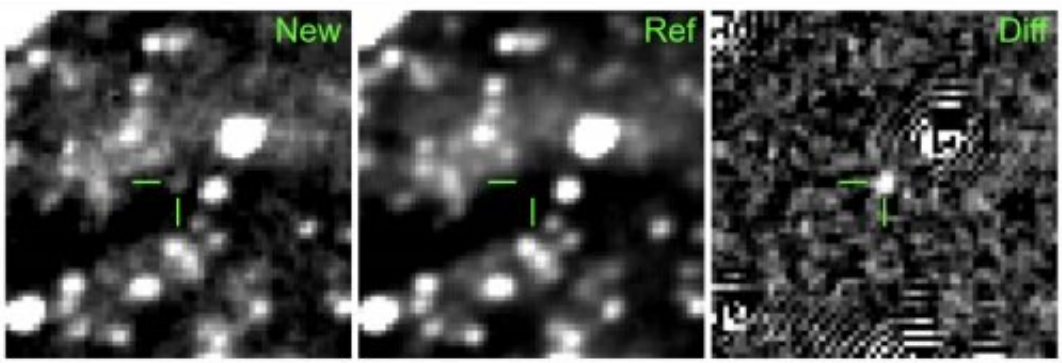

Discovery imaging sequence showing a 4' × 4' region centered on PGIR 20dci. Credit: Hillenbrand et al., 2021.

By analyzing datasets from the Palomar Gattini InfraRed survey (PGIR) and NASA's NEOWISE spacecraft, astronomers have identified an outbursting young stellar object (YSO) in the star-forming region NGC 281-W. The study, which reports the finding and sheds more light on the nature of the newfound YSO, was published Jan. 11 on arXiv.org.

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 5 to 6 magnitudes in amplitude and last from decades to even centuries.

However, still very little is known about the properties of outbursts in YSOs and there is a growing number of such events that are difficult to assign to one of the two known classes. Therefore, finding new outbursts and studying them in detail is essential to better understanding their nature.

Now, a team of astronomers led by Lynne A. Hillenbrand of the California Institute of Technology (Caltech) reports the finding of another outbursting YSO, which received designation PGIR 20dci. The source was first detected by PGIR on August 31, 2019, with a magnitude of 15.7 in the near-infrared J-band.

Since its discovery, PGIR 20dci has slowly increased in brightness. In general, its brightening trend observed during the 2019-2020 season has a linear slope of about -0.116 mag/month. The near-infrared imaging also revealed the existence of an extended scattered light nebula with a cometary-type structure about 14,000 AU in size.

The study confirms that PGIR 20dci is associated with the star-forming region NGC 281-W, located in the galaxy's Perseus spiral arm at a distance of some 9,130 light years away from the Earth. The total brightening of the source over the past 16 to 25 years was measured to be about 5 to 5.5 mag.

Furthermore, an investigation of the near-infrared absorption line

spectrum of PGIR 20dci delivered important information about the nature of this YSO.

"Recent near-infrared spectroscopy confirms the similarity of PGIR 20dci to FU Ori type sources, based on strong molecular absorption in CO, H_2O, and OH, weak absorption in several atomic lines, and a warm wind/outflow as indicated by a P Cygni profile in the He I 10830 ˚A line. (...) We conclude that PGIR 20dci is a bona fide FU Ori star," the astronomers wrote in the paper.

They noted that further studies, especially at high spectral dispersion, are required in order to get more insights into the properties of PGIR 20dci.

More information: Outbursting Young Stellar Object PGIR 20dci in the Perseus Arm, arXiv:2101.04203 [astro-ph.SR]
arxiv.org/abs/2101.04203