

The dimming and recovery of a young stellar object (YSO)

[CMD97]-1031 is a young star in the Mon R2 star-forming region in the constellation Monoceros, about 3,400 light-years away (~ 1050 parsec). It is an **X-ray-emitting star** with strong activity and has an **accretion disk**, as shown by its near-infrared glow. However, it has **less mid-infrared emission**, meaning there isn't much dust further out. Its motion suggests it belongs to the Mon R2 cluster.



Figure 1. The molecular cloud and embedded star cluster Monoceros R2.

The stars typical brightness was measured in the r-band with a median value of about 18 magnitudes. The star underwent a dramatic fading event - the brightness dropped by a factor of 10 over a 80-320 day period, say researchers Jiang and Hillendrand. During this deep fading the star also appeared to 'blink' up and down (short term fluctuations) by at least 2 magnitudes. This was followed by a slower more gradual recovery albeit to a fainter slightly redder colour. The post-dip brightness was, on average, **0.1 to 0.25 magnitudes fainter** across different datasets.

The study analyzes data from **Zwicky Transient Facility (ZTF)**, **Asteroid Terrestrial-impact Last Alert System (ATLAS)**, and **Gaia** spanning eight years 2014–2022. multiple wide-field were used to estimate the properties of this dip. A Gaussian fit was performed on the measurements taken by ZTF, MJD and ATLAS indicating a significant, asymmetric dip.

Although brightness variation is common in YSOs, which exhibit short duration variation, this is distinct in that this deep dimming over a longer time scale is rare but has been observed in other stars like ASASSN-21qj.

The study suggests that these long term fading may be caused by dusty material orbiting the star similar to UX-ori type variable (young pre-main sequence stars). Understanding this behaviour could provide insights into protoplanetary disk evolution and dust distribution around young stars. The event is one of the more extreme cases of variability seen in young stars, reinforcing the need for long-term monitoring to understand the processes at play.

<http://astroa.physics.metu.edu.tr/Astronom/SC/MONR2A.HTM>