Irregular dimming of a young stellar object investigated by astronomers

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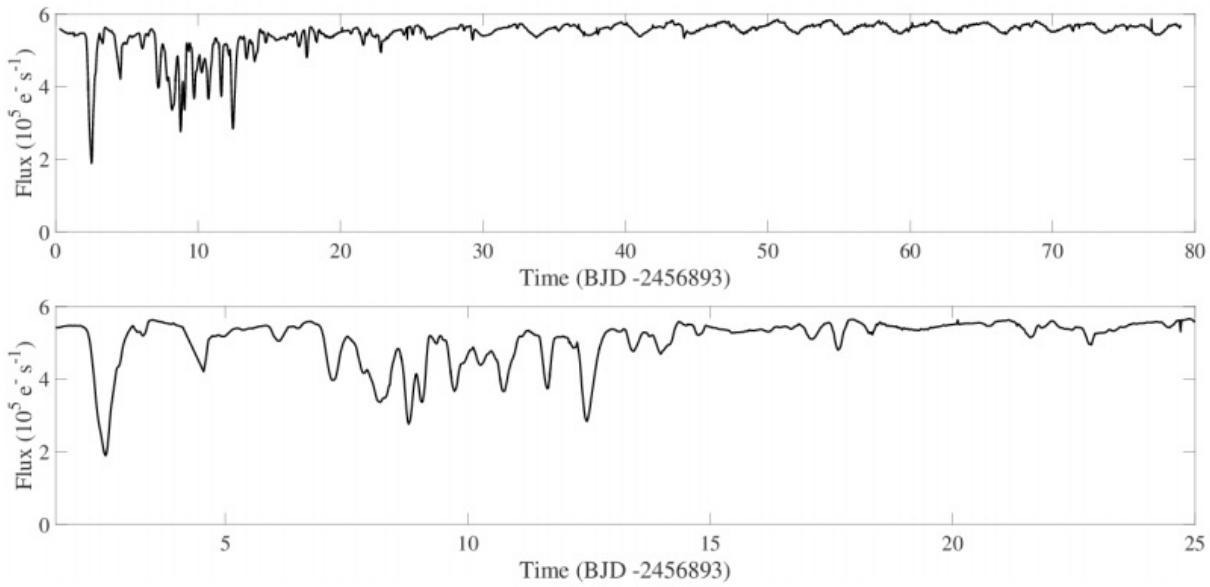

EPIC 204278916 light curve. The system was observed for over 78.8 days at 29.4 minute cadence. The units on the y-axis are electrons/second, and can be converted to Kepler magnitudes Kp using the conversion found in the Kepler Instrument Handbook. The top panel shows the full light curve, whilst the bottom panel zooms into the first 25 days of observation where the dipping events are observed. Credit: Scaringi et al., 2016.

(Phys.org)—New research conducted by a team of astronomers, led by Simone Scaringi of the Max Planck Institute for Extraterrestrial Physics in Germany, examines peculiar dimming of a newly found young stellar

object designated EPIC 204278916. The study tries to explain the nature of these dipping events observed in the object's light curve. The results were published Aug. 25 in a paper available on *arXiv.org*.

EPIC 204278916, is a young, pre-main-sequence star, about 5 million years old, of spectral type M1, located in the Upper Scorpius sub-group of the Scorpius-Centaurus OB association. It is the size of our sun in diameter, but has only 0.5 solar masses. This young stellar object was discovered by NASA Kepler spacecraft's prolonged mission known as K2, during its Campaign 2 between Aug. 23 and Nov. 13, 2014. Moreover, follow-up observations made with the Atacama Large Millimeter/submillimeter Array (ALMA) in Chile revealed that EPIC 204278916 also has a resolved tilted disk.

In a recent paper, Scaringi and his colleagues analyze the data provided by K2 and ALMA regarding EPIC 204278916, available in the Ecliptic Plane Input Catalog (EPIC) and the Mikulski Archive for Space Telescope (MAST) archive, with the aim to examine the object's light curve and its irregular dimmings in detail.

"We examine the K2 light curve in detail and hypothesize that the irregular dimmings are caused by either a warped inner-disk edge or transiting cometary-like objects in either circular or eccentric orbits," the researchers wrote in the paper.

According to the data provided by K2, EPIC 204278916 exhibited irregular dimmings of up to 65 percent for about 25 consecutive days out of 79 days of observations. The researchers also noted that when it comes to the remaining days of observation, this variability is highly periodic and could be attributed to stellar rotation.

One of the two most plausible explanations offered by the astronomers to explain the irregular dips in the object's light curve is that they are

caused by non-axisymmetric structures in the inner disk edge occulting EPIC 204278916. Due to the fact that these dimmings are at a level of up to 65 percent, the occulting material must have a large scale height comparable to the size of the object.

The researchers also noted that the dips in young stellar objects like EPIC 204278916 might be caused by transiting circumstellar objects. They emphasized that if transiting cometary-like bodies are responsible for the observed dips, the events are most likely occurring close to periastron passage.

However, more observations are definitely needed to fully understand the mysterious behavior of EPIC 204278916. Moreover, further continuous photometric and spectroscopic monitoring of this system for subsequent dipping events will help determine whether this behavior is periodic or not.

"It is clear that further observations of EPIC 204278916 and other young stellar object dippers will be required in the future, both photometric and spectroscopic, in order to establish their true origin. In particular, it is important to determine whether the observed dips in the K2 light curve of EPIC 204278916 are observed again, in which case infer their recurrence timescale and spectroscopic properties," the team concluded.

The researchers could soon get the opportunity to revisit EPIC 204278916, as in 2017 the K2 mission could re-observe the Scorpius-Centaurus OB association during the planned Campaign 15.

More information: The peculiar dipping events in the disk-bearing young-stellar object EPIC 204278916, arXiv:1608.07291 [astro-ph.SR] arxiv.org/abs/1608.07291

Abstract

EPIC 204278916 has been serendipitously discovered from its K2 light curve which displays irregular dimmings of up to 65% for ~25 consecutive days out of 78.8 days of observations. For the remaining duration of the observations, the variability is highly periodic and attributed to stellar rotation. The star is a young, low-mass (M-type) pre-main-sequence star with clear evidence of a resolved tilted disk from ALMA observations. We examine the K2 light curve in detail and hypothesise that the irregular dimmings are caused by either a warped inner-disk edge or transiting cometary-like objects in either circular or eccentric orbits. The explanations discussed here are particularly relevant for other recently discovered young objects with similar absorption dips.

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