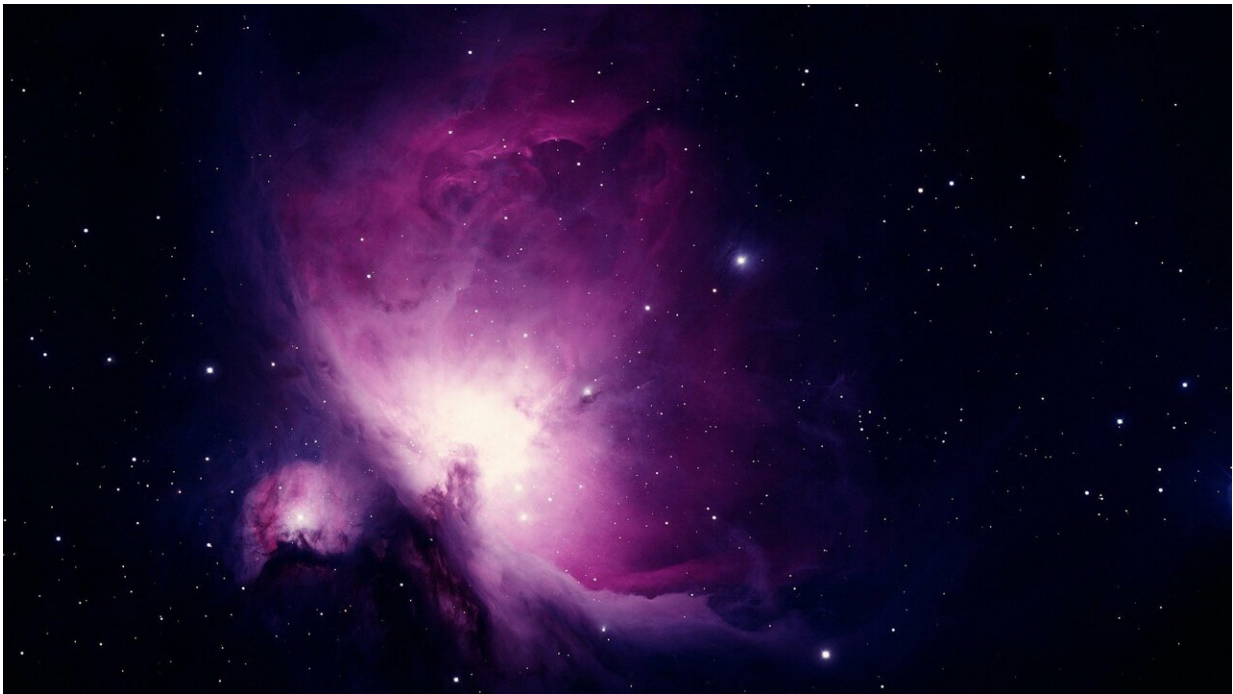


Existence of uneven circumstellar matter found based on TESS data

February 15 2022, by Li Yuan



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Researchers from the Yunnan Observatories of the Chinese Academy of Sciences have discovered unusual variations in the consecutive Transiting Exoplanet Survey Satellite (TESS) light curves of the supersoft X-ray source V Sge. This is the first evidence to reveal that there may be uneven circumstellar matter surrounding the supersoft X-ray source.

This work was published in *Monthly Notices of the Royal Astronomical Society* on Feb. 2.

V Sge is a unique eclipsing cataclysmic binary and a recognized supersoft X-ray source, consisting of a compact white dwarf primary component and a main-sequence star companion. The white dwarf continuously accretes mass from the companion through the [accretion](#) disk.

To further study their mass exchange and the resulting orbital evolution, the researchers monitored them using the one-meter telescope at Yunnan Observatories and then obtained their minimum timings of the eclipse.

Combining with the more continuous TESS light curve, the researchers analyzed the orbital period variation of V Sge in detail. The result implied that the orbital period is decreasing continuously, indicating that the more massive companion is transferring material to the white dwarf during its evolution on the thermal timescale, as well as the possible mass loss from the accretion disk takes away the angular momentum of this system.

Based on the result of the orbital period analysis, researchers derived the latest rate of [orbital period](#) change for this system, and then, in the case of the consequential angular momentum loss (CAML) caused by the accretion disk wind, they estimated the range of mass transfer rate and mass accretion rate. Moreover, it can be roughly estimated that V Sge might reach to Chandrasekhar limit in at least 1Myr, then might explode as a type Ia supernova.

In addition, the researchers found evidence of the existence of uneven circumstellar matter surrounding the supersoft X-ray source. They discovered that there are peculiar and irregular changes in the more continuous TESS light curve of V Sge, which may be caused by the

extinction effect of the uneven circumstellar matter and dynamic changes of the shape of the [accretion disk](#) edge.

These variations provide researchers with an opportunity to understand the [mass transfer](#) and [mass](#) ejection process better. However, the law of these variations and the mechanism resulting in those need to be further confirmed yet.

More information: Lei Zang et al, Photometric study of the supersoft X-ray source V Sge based on TESS data, *Monthly Notices of the Royal Astronomical Society* (2022). [DOI: 10.1093/mnras/stac047](https://doi.org/10.1093/mnras/stac047)

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