

Recurrent nova system

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In news— Astronomers tracking the constellation Ophiuchus have spotted a recurrent nova system approximately 5,000 light-years away.

What is recurrent novae system?

- Recurrent novae are defined as systems with more than one recorded nova outburst.
- It is a transient astronomical event that causes the sudden appearance of a bright, apparently “new” star that slowly fades over weeks or months.
- Recurrent novae are thought to arise in the same way as classical novae, through a white dwarf in a close binary system accreting a surface layer of hydrogen from a main sequence companion.
- Once the temperature at the bottom of this hydrogen layer reaches about 10 million Kelvin, a runaway thermonuclear reaction takes place which ejects the unburnt hydrogen into a rapidly-expanding shell around the white dwarf. This is the nova outburst.
- While classical novae have only been seen in outburst once, recurrent novae have undergone at least two outbursts over the past century (since astronomers started taking notice).
- The time interval between outbursts varies from 10 to 100 years, and astronomers propose that classical novae will be seen as recurrent novae given enough time.

Key findings-

- Researchers study of data from the outburst of the star called RS Ophiuchi detected on August 8, 2021, which shows hot, central ionizing white dwarf with a constant luminosity but rapid temperature within the span of a month, may hold the key to understanding the formation

of Type Ia supernovae.

- **A Type Ia supernova is a rare type of supernova that occurs in binary systems** (two stars orbiting one another) in which one of the stars is a white dwarf.
- **The star system RS Ophiuchi has shown recurrent eruptions since 1985.** The latest has been in August 2021, when it reached a peak visual magnitude of 4.6 – bright enough to be seen with the naked eye. **It is a binary system of a white dwarf star and a red giant**, in which the latter supplies the white dwarf with fresh, hydrogen-rich fuel for nova eruption.
- With enough fuel, the material on the surface of the white dwarf achieves a critically high temperature and pressure, and a thermonuclear runaway (TNR) ensues, which lasts for about 1000 seconds. This explosion generates huge energy making the system visible from a far distance.
- Scientists have been looking for clues from the 2021 eruption to probe into this star system which has shown **recurrent phases of becoming Nova–star that suddenly becomes much brighter for a short period.**
- The astrophysics team at S.N. Bose National Centre for Basic Sciences (SNCBS), an autonomous institute of the Department of Science and Technology (DST), acquired data from Astronomical Ring for Access to Spectroscopy Database (ARASD) to study the **evolving spectra of the RS Ophiuchi Nova.**
- The astrophysics team at the S.N. Bose Centre, **found that with every eruption, the white dwarf accretes at least 10% of the ejected mass.** They believe that eventually, it will explode as a Type Ia supernova.
- This event, if and when it occurs, will be the final proof of the conjecture around Type Ia supernova which states that if a white dwarf crosses the Chandrasekhar Limit of 1.4 Solar Mass, it collapses under its own gravitational pressure and gives birth to a Type Ia supernova.

- This is because the electron degeneracy pressure in the core of the star is no longer sufficient to balance the gravitational pressure, leading to its collapse.
- The mass of the white dwarf in the RS Oph binary is estimated to be 1.2 to 1.38 solar mass. They carried out this study with the help of a model called 3D morpho kinematic model of the ejecta.
- As per the researchers there are ten recurrent novae in the Milky Way Galaxy, but since 1988, there has not been a supernova explosion in the Milky Way.