

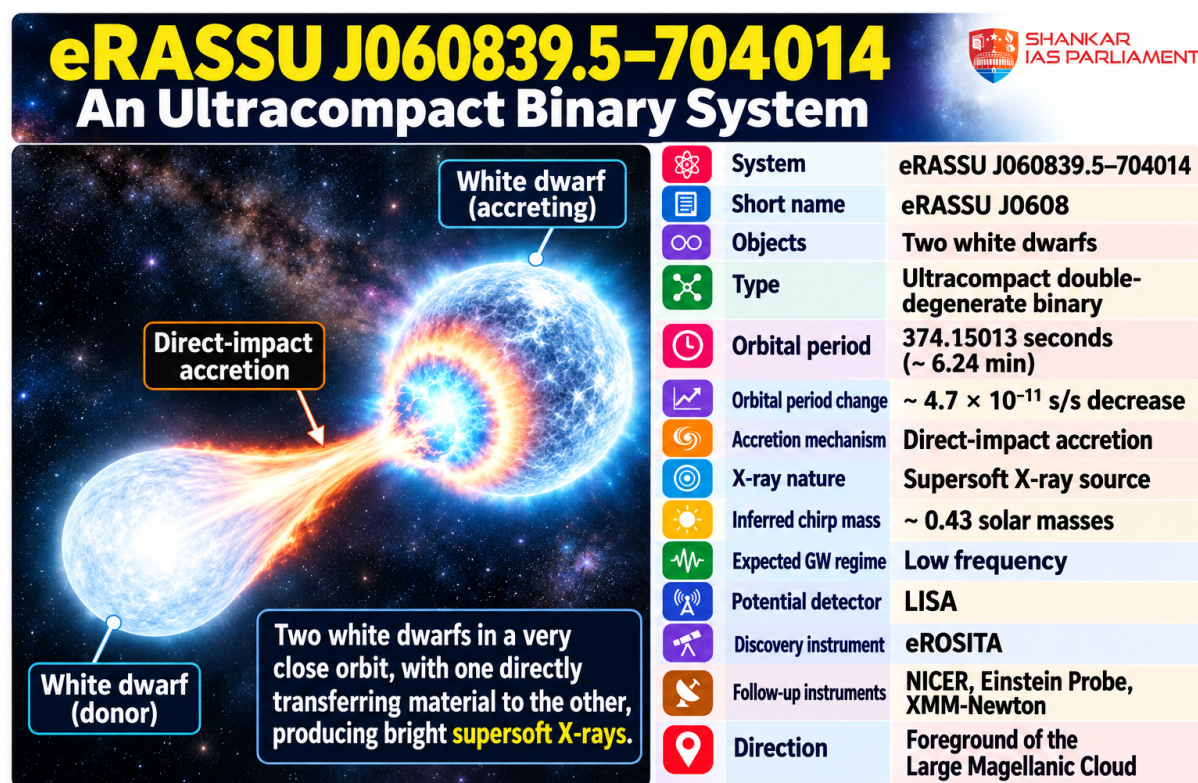
eRASSU J0608: Ultracompact White-Dwarf Binary

Prelims: Current events of national and international importance | Space

Why in News?

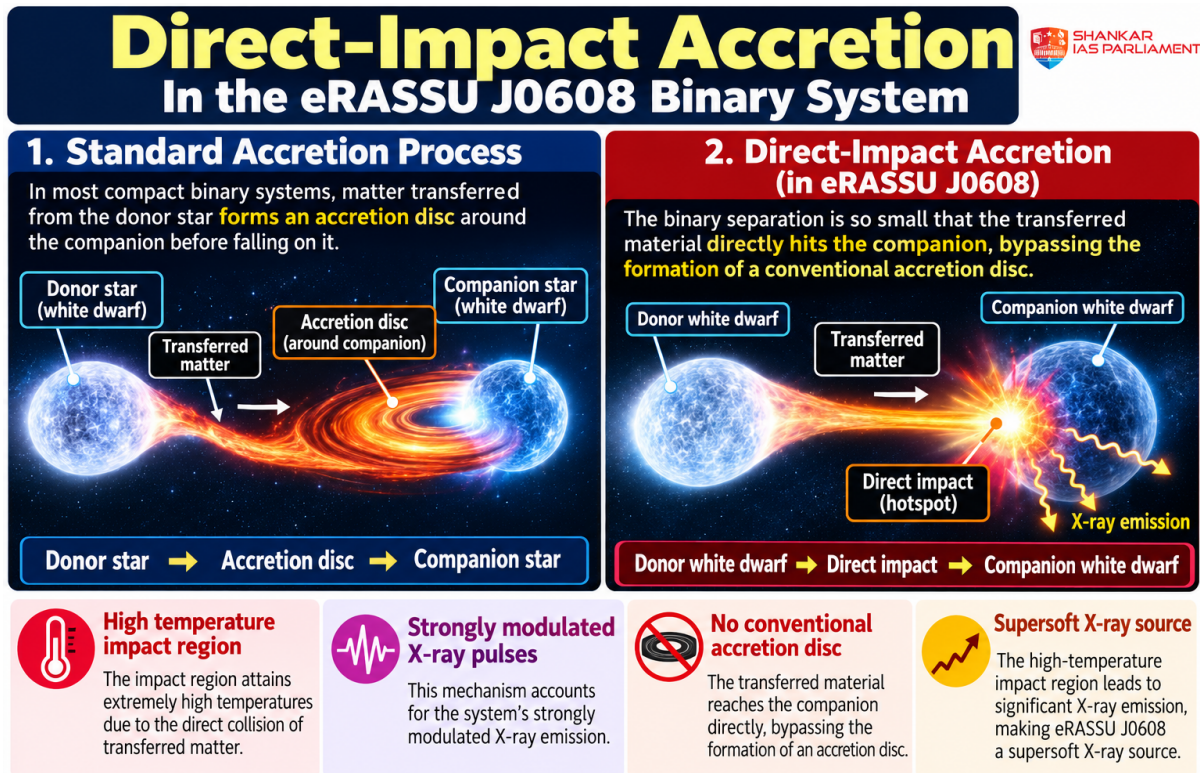
An international team led by Indian astronomers has studied an ultracompact binary system of two white dwarfs, known as eRASSU J0608.

- **Study** - Rapid Orbital Decay in the Ultracompact Double-Degenerate Binary eRASSU J060839.5–704014



- The system completes a single orbit in **374.15013 seconds**, which is approximately **6.24 minutes**.
- The orbital period is decreasing at an unusually rapid rate.
- This system is a potential significant source of **low-frequency gravitational waves**.
- The system could serve as a **verification source for LISA**, the planned space-based gravitational-wave observatory.
- **Ultracompact double-degenerate binary**
 - **Double-degenerate binary** - A binary system composed of two degenerate stellar remnants, such as white dwarfs.

- **Ultracompact binary** - A binary system in which the two objects are separated by a very small distance and possess an extremely short orbital period.
- **Direct-Impact Accretion** - Typically, matter transferred between compact stars follows a standard accretion process:
 - **Donor star → Accretion disc → Companion star**
- In contrast, within the eRASSU J0608 system:
 - **Donor white dwarf → Direct impact → Companion white dwarf**



- The binary separation is sufficiently small that transferred material reaches the companion directly, bypassing the formation of a **conventional accretion disc**.
- **As a result**, the impact region attains extremely high temperatures, resulting in significant X-ray emission.
- This mechanism accounts for the system's strongly modulated X-ray pulses.
- **Chirp mass** - It is a parameter calculated from the **masses of the two components in a binary system**.
- It is particularly important because it determines aspects of:
 - Orbital evolution
 - Gravitational-wave frequency evolution
 - Gravitational-wave amplitude

In the case of eRASSU J0608 - Chirp mass ≈ 0.43 solar masses.

- **Large Magellanic Cloud**
 - The system is positioned in the **direction of the Large Magellanic Cloud (LMC)**.
 - However, being located in the direction of the LMC does not necessarily imply

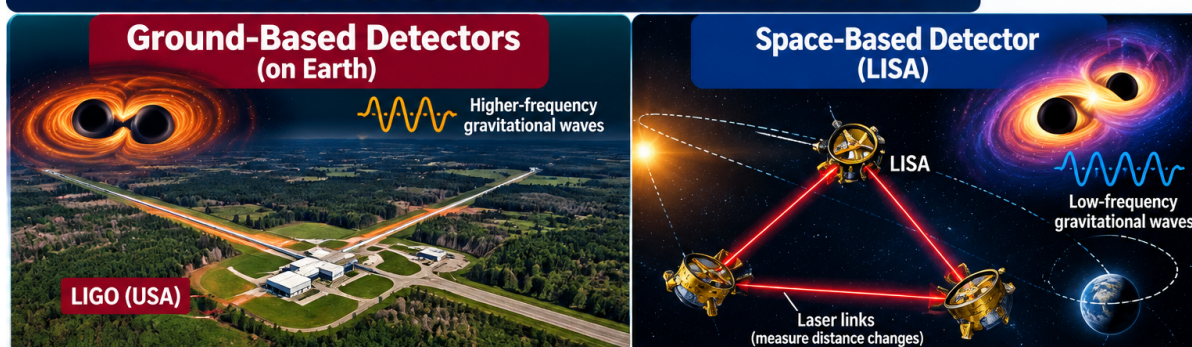
physical association with or location within the LMC.

- The study suggests that eRASSU J0608 is likely situated **in the foreground of the LMC; however, its precise distance remains undetermined.**

Large Magellanic Cloud

- The Large Magellanic Cloud is a satellite galaxy of the **Milky Way**.
- It is part of the **Local Group of galaxies**.
- The Large Magellanic Cloud is classified as a nearby dwarf irregular galaxy.
- It accompanies the Milky Way, together with the **Small Magellanic Cloud**.

Ground-Based vs Space-Based Gravitational-Wave Detectors



Feature	Ground-based detectors	LISA (Space-based)
Location	Earth	Space
Example	LIGO, Virgo, KAGRA	LISA
Frequency range	Higher-frequency GWs	Low-frequency GWs
Major targets	Stellar-mass compact mergers	Compact binaries, massive black-hole systems etc.
eRASSU J0608	Less suitable	Potentially suitable

Reference

[TOI | Ultracompact White-Dwarf Binary](#)