

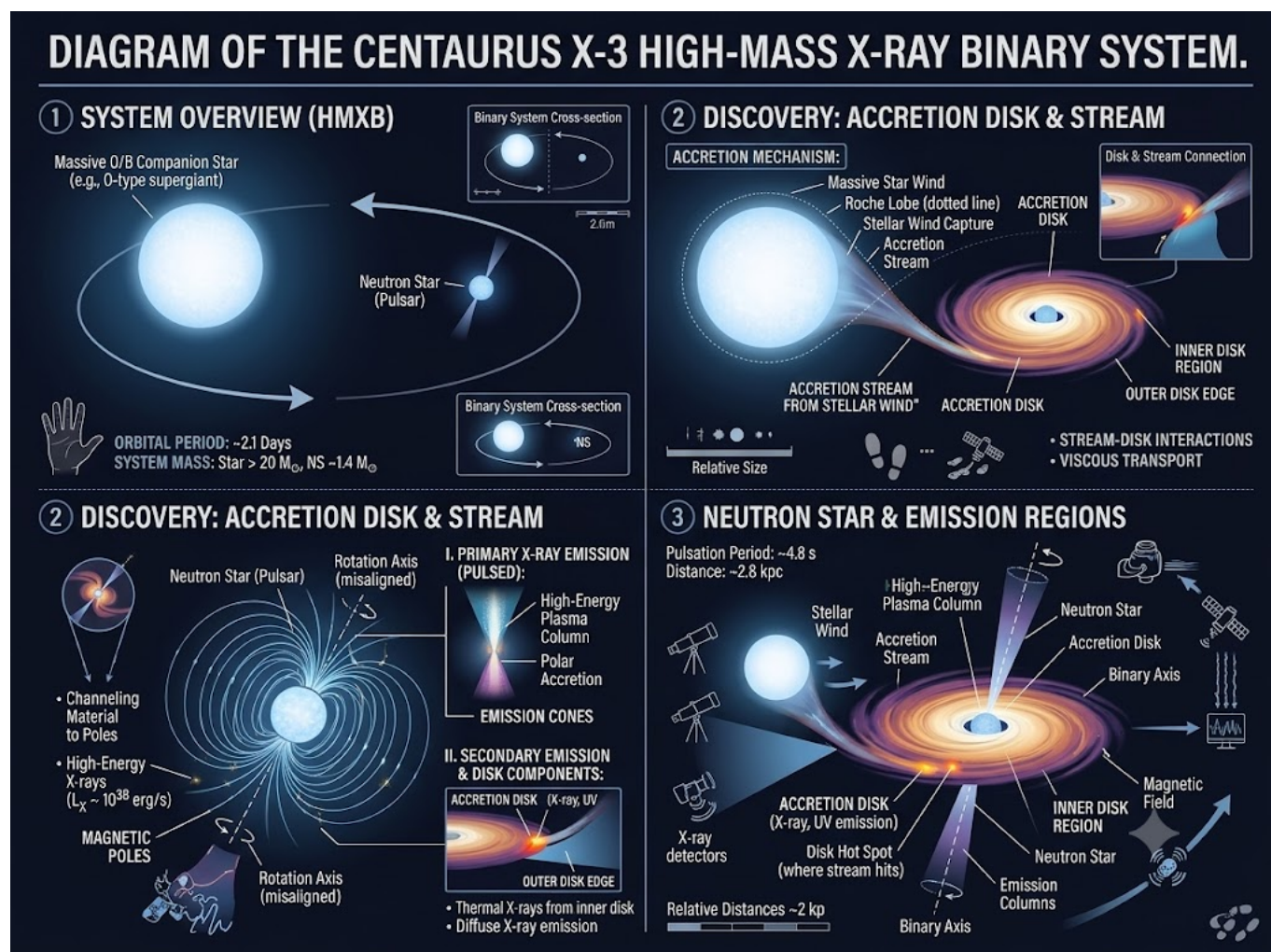
Hidden Structure Around Neutron Star Centaurus X-3

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Why in News?

Recently, scientists from the Raman Research Institute (RRI), Bengaluru made a breakthrough discovery regarding Centaurus X-3, one of the brightest and most widely studied X-ray pulsars in the universe.

Key Technical Mechanisms



Centaurus X-3

- It is a **High-Mass X-ray Binary (HMXB)** system located roughly 24,000 light-years away in the constellation Centaurus.
- It features a highly magnetized neutron star (pulsar) coupled with a companion star more than

10 times the mass of the Sun.

Primary vs. Secondary Emission

- **Primary Emission** - Intense radiation beamed directly out of the pulsar's magnetic poles.
- **Secondary Emission**- Radiation absorbed and re-emitted by the intricate structures surrounding the neutron star.
- Because distant X-ray binaries appear merely as point sources, tracking the rotational variations of these secondary emission lines acts as an optical/X-ray "diagnostic tool".

The Accretion Discovery

- By analyzing four specific secondary emission lines, RRI researchers found that the emitting structure co-rotates with the pulsar.
- This confirmed the existence of an **accretion stream** channeling matter from an **accretion disk** directly onto the neutron star.

Scientific Significance

- High-mass X-ray pulsars typically draw material via stellar winds rather than a distinct, disk-fed accretion mechanism. This discovery mandates a revision of standard evolutionary models for systems like Centaurus X-3.
- Accurately mapping these circumstellar structures allows astrophysicists to determine critical physical parameters—such as the system's orbital orientation, plasma dynamics, and extreme magnetic field strengths.

Reference

[PIB | Signals reveal hidden structure around a famous neutron star](#)