Magnetars

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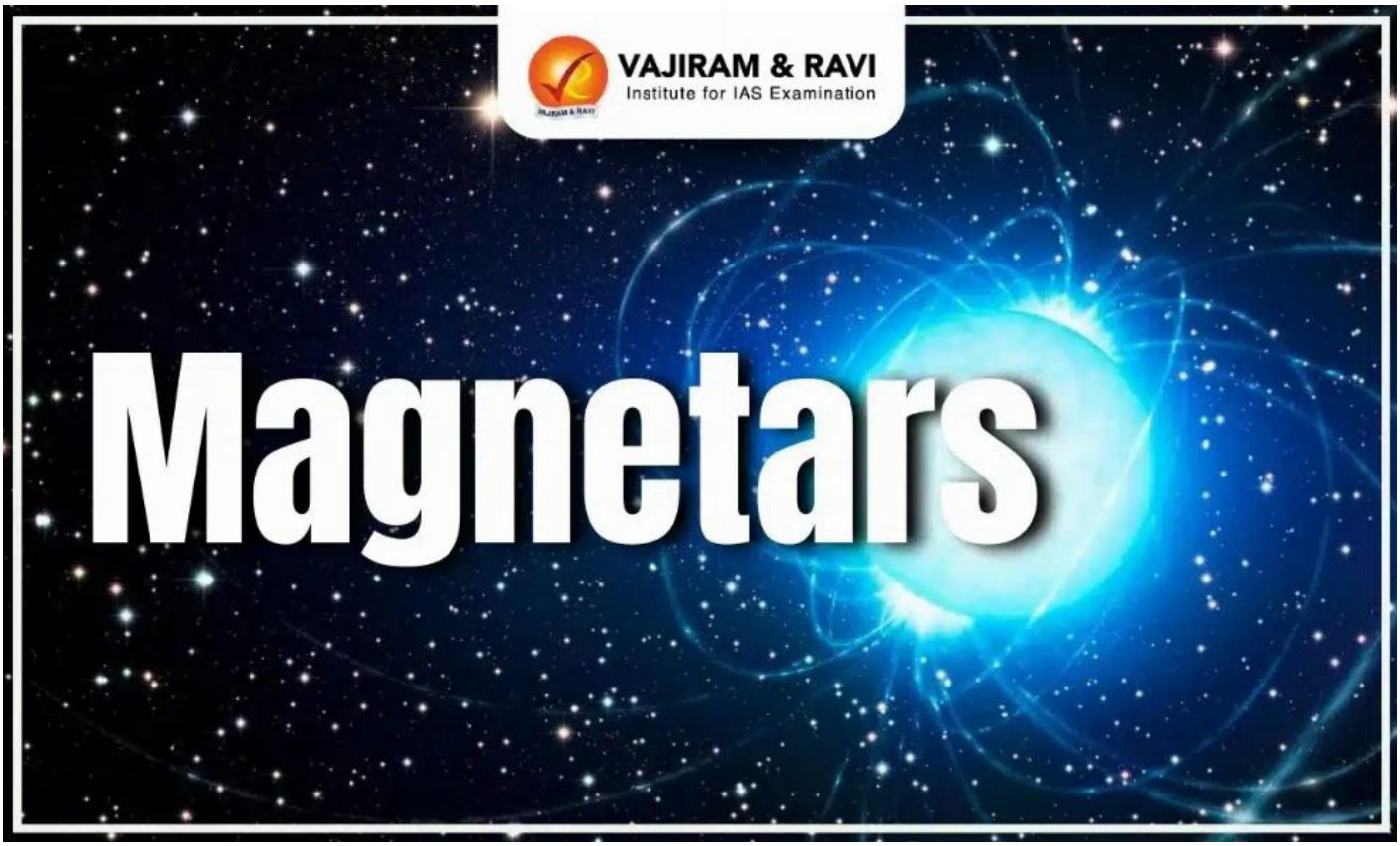

Magnetars Latest News

Researchers have found observational evidence that magnetar flares can produce heavy elements like gold through a process known as r-process nucleosynthesis. Until now, gold was believed to form predominantly in neutron star mergers.

What Are Magnetars?

- **Magnetars** are a type of **neutron star** characterised by **exceptionally strong magnetic fields**, estimated to be a **thousand times stronger than typical neutron stars**. Occasionally, they emit **intense bursts of energy** in the form of **flares**.
- The discovery was based on data from a **giant flare emitted by a magnetar in 2004**, during which **unusual gamma-ray emissions** were recorded almost a **day after the initial flare** by NASA's **Compton Gamma Ray Observatory**.
- The **delayed emission** was not consistent with **standard flare afterglows**. Instead, it displayed **signatures of radioactive decay** from **neutron-rich isotopes**, suggesting the presence of **r-process**

nucleosynthesis.

What Is R-Process Nucleosynthesis?

- The **r-process** or **rapid neutron-capture process** is a series of nuclear reactions where **atomic nuclei rapidly capture neutrons**, forming **heavy elements like gold, platinum, and uranium**. It requires **extreme energy environments** and **neutron-rich matter**.
- Researchers estimated that approximately **1.9 septillion kg** of r-process material was **ejected at nearly light speed** during the flare. This material likely underwent **rapid neutron capture**, resulting in the **synthesis of heavy elements**.
- This discovery suggests that **magnetars could have contributed to the universe's heavy element inventory** much **earlier** than **neutron star collisions**, offering insights into the **chemical evolution of galaxies**.

Magnetars FAQs

Q1. What is a magnetar?
Ans: A magnetar is a type of neutron star with an extremely powerful magnetic field, up to 1,000 times stronger than typical neutron stars.

Q2. What are magnetar flares?
Ans: Magnetar flares are intense bursts of X-rays and gamma rays caused by magnetic field instability or starquakes on a magnetar's surface.

Source: TH
