



KAMARAJ IAS ACADEMY
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China Completes Jiangmen Underground Neutrino Observatory (JUNO)

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China has completed the **Jiangmen Underground Neutrino Observatory (JUNO)**, a major facility for neutrino research, while the **India-based Neutrino Observatory (INO)** has been stalled for years.

About JUNO:

Purpose: Study **neutrino properties**, including **mass hierarchy and oscillations**.

Significance: Neutrinos help understand the **origin of the universe, matter-antimatter imbalance, and particle physics beyond the Standard Model**. Neutrinos are produced in the **Sun, nuclear reactors, and cosmic events**, and they **rarely interact with matter**, which makes them very difficult to detect and which are extremely tiny, almost massless particles.

Scale: One of the **largest neutrino detectors** in the world, built underground to shield from cosmic radiation.

Why it's important:

1 Fundamental Science: Neutrinos help scientists understand the **origin of the universe, matter-antimatter imbalance, and physics beyond the Standard Model**.

2 Particle Physics Advancement: JUNO aims to solve key mysteries, like the **neutrino mass hierarchy**, which is a fundamental property of these particles.

3 Global Scientific Leadership: By completing JUNO, China is **ahead in cutting-edge particle physics research**, while India's similar project (**INO**) remains stalled.

4 Technological Spin-offs: Large-scale detectors like JUNO drive advances in **detector technology, data analysis, and material science**, which can have broader applications.

Implications for India

- Highlights the **need for timely execution** of large-scale scientific projects like INO.
- Offers potential for **international collaboration** in cutting-edge particle physics.
- Emphasises the importance of **policy support, funding, and environmental clearances** in scientific infrastructure.

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