



# India based Neutrino Observatory

## Why in News

An [India based Neutrino Observatory](#) (INO) is going to be set up in Bodi West Hills, in Theni district, Tamil Nadu.

## Key Points

- **About :** INO Project is a multi-institutional effort aimed at building a world-class underground laboratory with a rock cover of approx. 1200 m for non-accelerator based high energy and nuclear physics research in India.
- **National Neutrino Collaboration group (NNCG):** It includes more than 50 scientists from about 15 Institutes and Universities in India and is tasked with detailing various aspects related to INO activity and come up with a proposal for an underground neutrino laboratory.
- **Funded by :** Dept. of Atomic Energy (DAE) and the Dept. of Science and Technology (DST).
- **Objectives:** INO will observe neutrinos and antineutrinos produced in the atmosphere of the Earth.
  - Over the years this underground facility is expected to develop into a full-fledged underground science laboratory for other studies in physics, biology, geology, hydrology etc.
- **Features:** The project includes:
  - **Underground laboratory** and associated surface facilities at Bodi West Hills.
  - Construction of a **magnetized Iron Calorimeter (ICAL)** detector for studying neutrinos.
    - When completed, ICAL will have the **world's largest magnet.**
  - Setting up Inter **Institutional Centre for High Energy Physics (IICHEP)** at Madurai
- **Advantages:**
  - This observation will tell us more about the properties of neutrino particles, whose main source is the **Sun and the Earth's atmosphere.**
  - This will also help in **developing a model of physics** beyond the so-called Standard Model of Particle Physics.
    - The Standard Model of particle physics is the theory describing three of the four known fundamental forces (the electromagnetic, weak, and strong interactions, and not including the gravitational force) in the universe, as well as classifying all known elementary particles i.e. electrons, protons and neutrons.
  - It would also have a great impact on diverse fields such as **nuclear and particle physics, astrophysics and cosmology, medical imaging etc.**
- **Issues Involved:**
  - The project was challenged before the **National Green Tribunal (NGT)** for adversely affecting the ecosystem of Western Ghats. However , it was granted **environmental clearance by NGT.**
  - The **villagers in the Pottipuram Panchayat (at Bodi West Hills)** have been agitating against the proposed observatory under the banner of Poovulagin Nanbargal (Friends of

the earth).

## Neutrinos

- Detected for the first time in 1959, neutrinos are the **second most abundant particles** in the world (about a billion of them pass through a cubic centimeter of space every second), after photons, or the light particle.
- Neutrinos are **subatomic fundamental particles**, with **no charge and little or zero mass** that interacts only via the weak subatomic force and gravity.
- Neutrinos are created by various radioactive decays; during a supernova, by cosmic rays striking atoms etc.
- They are considered mass less according to the Standard Model of Particle Physics.
- However recent experiments indicate that these charge-neutral fundamental particles have **finite but small mass** which is unknown. Also, different species (or flavours ) of neutrinos seem to mix and oscillate into one another as they traverse through the cosmos.
- **Determination of neutrino masses** is one of the most important open problems in physics today. Neutrino Detectors are used to study the details of the interactions of these particles
- They pass seamlessly through most objects that come in their way, including human beings, machines or the Earth's surface, without being noticed. That is the reason why scientists have to go deep underground to set up special detectors in a bid to catch the faint signals of neutrinos in an environment that is relatively free from 'noise' and disturbance.

**Source: PIB**

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