Neutrino Observation

What is the issue?

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People from several walk of life fear about the proposed Indian Neutrino Observatory project in Tamil Nadu due to lack of awareness.

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What are neutrinos?

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- The only particle other than gravitational waves that can zip through the universe at speeds very close to that of light are called neutrinos.
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- The biggest nuclear reactor that most life on earth derives energy from is the sun.
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- Like all nuclear reactors, **in addition to giving out energy (heat and light), the sun also emits neutrinos.**
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What is Standard Model?

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- **All the laws and forces of nature that we know** of, other than gravitation, are described by what physicists call the Standard Model.
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- It predicted that neutrinos, which come under three types or flavours — **tau-neutrino, electron-neutrino and muon-neutrino** — would not oscillate from one flavour to another.
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- The discovery that they do meant that the Standard Model or the basic laws of physics had to be further modified.
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- Thus, through the neutrino detectors we are actually observing the fundamental laws of physics at the cutting edge.
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What INO will do?

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- The proposed India-based Neutrino Observatory (INO) aims to observe muon neutrinos that are continuously produced in the atmosphere when cosmic rays strike the earth.
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- Since every type of matter particle has an anti-matter partner particle associated with it, there are also anti-neutrinos that the INO can observe.
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- Anti-neutrinos also come in three flavours and can oscillate from one to the other.
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- The INO, by observing the rates at which neutrinos and anti-neutrinos oscillate, will make a substantial contribution to the quest to unravel the secrets of the ultimate laws of physics.
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Is there anything to fear?

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- There are some baseless allegations that the INO, which is just like a telescope, causes radioactivity and have compared it with the dangers of having a nuclear power plant or radioactive material in the neighbourhood.
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- This cannot be true since the neutrinos are very feeble and weakly interacting particles that we can’t even see or feel without the help of an observatory.
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- Beams of neutrinos are being sent to the NOvA neutrino detector in the U.S. and to the T2K neutrino detector in Japan every day.
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- Moreover, being the lightest matter particles, the neutrinos do not decay

into any other particles, as everything else is heavier.
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- So they are not like uranium which decays radioactively into smaller atoms.
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- All the INO would do is to provide the lens to observe neutrinos as they are too feeble or faint to be detected by the naked eye.
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Source: The Hindu

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