Ultra-High-Energy Cosmic Neutrinos

Prelims- *Current events of National and International Importance| Science & Technology*

Why in News?

Recently, scientists announced the detection of ultra-high-energy cosmic neutrinos by the IceCube Neutrino Observatory, carrying roughly 10 billion times the energy of typical solar neutrinos.

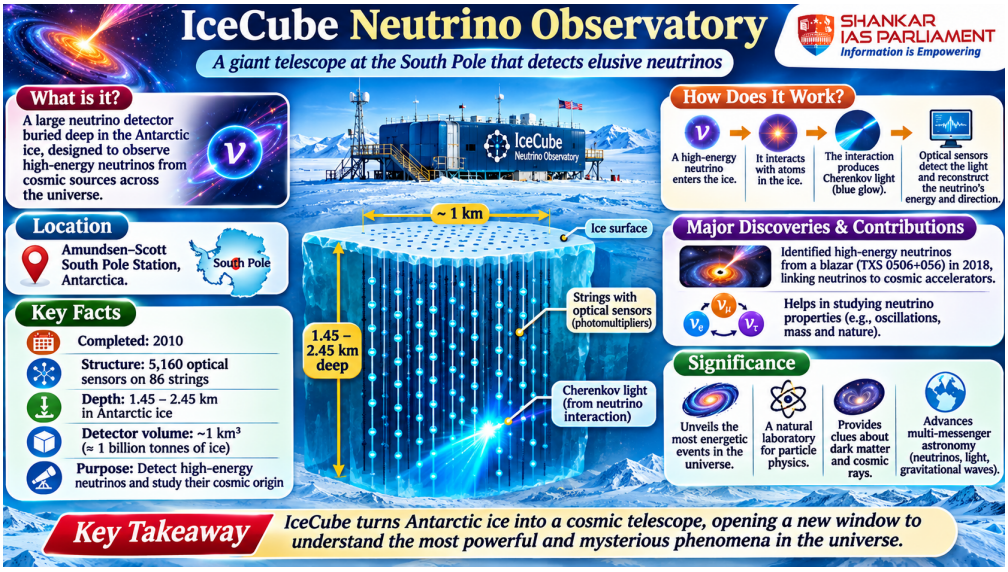
Details of the Discovery

- **Energy Levels-** The detected cosmic neutrinos possess energies about 10 billion times higher than standard neutrinos coming from the Sun.
- **Detection Date-** Reported publicly by researchers on November 2, 2026.
- **Observatory-** Captured using the **Ice Cube Neutrino Observatory.**
- **Scientific Impact-** These ultra-high-energy "ghost particles" travel straight from extreme extragalactic accelerators—such as active galactic nuclei and black hole environments—without getting deflected by magnetic fields, helping solve long-standing mysteries about the origin of high-energy cosmic rays.

What are Neutrinos?

- Neutrinos are tiny, electrically neutral, fundamental subatomic particles that pass through normal matter almost completely undisturbed.
- Often called **"ghost particles,"** they are among the most abundant massive particles in the universe.
- **Key Properties**
- **No Charge-** Neutrinos carry zero electric charge, meaning they do not feel electromagnetic forces.
- **Tiny Mass-** They have an extremely small rest mass—millions of times lighter than an electron—though exact measurements are still being studied.
- **Weak Interaction-** They interact with other matter only through gravity and the weak nuclear force. Tens of trillions of solar neutrinos stream through your body every second without you feeling a thing.
- **Three Flavors-** Neutrinos come in three types, or "flavors"– **electron neutrino**, **muon neutrino**, and **tau neutrino**.
- **Where Do They Come From?**
- **The Sun and Stars-** Nuclear fusion in the sun produces a massive flow of solar neutrinos.

- **Radioactive Decay–** They are released when atomic nuclei break apart or transform, such as in radioactive decay, nuclear reactors, or particle accelerators.
- **Cosmic Events–** Supernovae, cosmic rays, and the ancient aftermath of the Big Bang (forming a cosmic neutrino background) fill space with them.



Reference

[Nature| Ultra-High-Energy Cosmic Neutrinos]

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