Recently, NASA’s Antarctic Impulsive Transient Antenna (ANITA) has detected the unusual upward movement of neutrinos in Antarctica.

Background

Instead of the high-energy neutrinos streaming in from space, they seem to have come from the Earth’s interior, before hitting the detectors of ANITA. Usually, the high-energy particles move top to bottom (i.e. from space to the earth). However, ANITA has detected an anomaly i.e. particles have been detected travelling bottom to top.

Earlier, researchers had also located a deep-space source for high-energy neutrinos through the Ice Cube Neutrino Observatory at a U.S. scientific research station at the South Pole in Antarctica (PT). The India-based Neutrino Observatory (INO) is located at the Bodi West Hills region in Theni District of Tamil Nadu.

Antarctic Impulsive Transient Antenna

About

Antarctic Impulsive Transient Antenna (ANITA) is a radio telescope instrument to detect ultra-high energy cosmic-ray neutrinos from a scientific balloon flying over the continent of Antarctica.

It involves an array of radio antennas attached to a helium balloon which flies over the Antarctic ice sheet at 37,000 meters. At such a height, the antennas can listen to the cosmos and detect high-energy particles, known as neutrinos, which constantly bombard the planet.

- It is the first NASA observatory for neutrinos of any kind.
- ANITA detects neutrinos pinging in from space and colliding with matter in the Antarctic ice sheet through the Askaryan effect
- The Askaryan effect is the phenomenon whereby a particle traveling faster than the phase velocity of light in a dense dielectric (such as salt, ice or the lunar regolith) produces a shower of secondary charged particles.
  - When neutrinos smash into an atom, they produce a shower of detectable secondary particles. These detectable secondary particles allow us to probe where they came from in the universe.
  - However, neutrinos pose no threat to human beings and pass through most solid objects. Additionally, they rarely do interact with matter. It is named after Gurgen Askaryan, a Soviet-Armenian physicist who postulated it in 1962.

Neutrinos

- Neutrinos are electrically neutral, undisturbed by even the strongest magnetic field, and rarely interact with matter. The direction from which they arrive points directly
Neutrinos are produced during natural radioactive decays and all sorts of nuclear reactions in nuclear power reactors, particle accelerators or nuclear bombs. However, the most common sources of neutrinos are celestial phenomena i.e. the birth and death of stars, collisions, and explosions happening in space.

Conclusion

The ANITA experiment has definitely detected something unusual and unexpected about neutrinos but there are many competing theories about it. There are a number of potential candidate particles that could account for the results from ANITA.

Further, there are so many unknown properties about neutrinos that astrophysicists and scientists are still trying to unravel. It contemplates that there is new physics out there to be found which will help to study the origin of the universe and big bang theory in the future.