

Baikal GVD detector

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In news : Recently, the Russian scientists launched one of the world's biggest underwater neutrino telescopes called the Baikal-GVD (Gigaton Volume Detector) in the waters of Lake Baikal,

About Baikal-GVD

- The Baikal deep underwater neutrino telescope (or Baikal-GVD – Gigaton Volume Detector) is an international project in the field of astroparticle physics and neutrino astronomy
- Goal: Its primary goal is the detailed study of the flux of high-energy cosmic neutrinos and the search for their sources.
- Baikal-GVD will also search for dark matter candidates, for neutrinos from the decay of super heavy particles, for magnetic monopoles and other exotic particles.
- The telescope is one of the three largest neutrino detectors in the world along with IceCube at the South Pole and ANTARES in the Mediterranean Sea.
- The Baikal-GVD collaboration includes 10 institutions from 6 countries, along with various contractors and partners.

Timeline of the Baikal GVD

- The preparatory phase of the project was concluded in 2015
- The construction of the first phase of Baikal GVD (GVD-I) was started in 2016

Baikal GVD and detecting neutrinos

- Neutrinos are abundant in nature, with about a thousand trillion of them passing through a human body every

second.

- Neutrinos are the second most abundant particles, after photons, which are particles of light. But while neutrinos are abundant, they are not easy to catch, this is because they do not carry a charge, as a result of which they do not interact with matter.
- One way of detecting neutrinos is in water or ice, where neutrinos leave a flash of light or a line of bubbles when they interact.
- To capture these signs, scientists have to build large detectors.
- **An underwater telescope such as the GVD is designed to detect high-energy neutrinos that may have come from the Earth's core**, or could have been produced during nuclear reactions in the Sun.

Significance of the project

Studying the fundamental particles called neutrons and their sources will aid scientists' understanding of the origins of the universe since some neutrinos were formed during the Big Bang, others continue to be formed as a result of supernova explosions or because of nuclear reactions in the Sun

About Fundamental particles

- Fundamental means that neutrinos, like electrons, protons and neutrons cannot be broken down further into smaller particles.
- As of now the understanding is that the universe is made of some fundamental particles that are indivisible.
- Broadly, particles of matter that scientists know about as of now can be classified into quarks and leptons. But this only applies to "normal matter" or the matter that scientists know that five per cent of the universe is made up of
- Not much is known about the remaining 95 per cent of the universe, which is classified by the authors into dark

matter (27 percent) and the remaining 68 per cent of the universe of which scientists have “no idea” about yet.

- Scientific exploration in the field of physics so far has led to the discovery of over 12 such quarks and leptons, but three of these (protons, neutrons and electrons) is what everything in the world is made up of.
- Protons (carry a positive charge) and neutrons (no charge) are types of quarks, whereas electrons (carry a negative charge) are types of leptons.
- These three particles make what is referred to as the building block of life– the atom.
- In different combinations, these particles can make different kinds of atoms, which in turn make up molecules that form everything– from a human being, to a wooden chair, a plastic plate, a mobile phone, a dog, a termite, a mountain, a planet, water, soil etc.

Need for the study of fundamental particles

- Studying what humans and everything around them is made up of gives scientists a window into understanding the universe a better way
- This is one reason why scientists are so keen on studying neutrinos (not the same as neutrons), which are also a type of fundamental particle.