



# Baikal-GVD Telescope

## Why in News

**Russian scientists** have launched **one of the world's biggest underwater neutrino telescopes** called the **Baikal-GVD (Gigaton Volume Detector)** in the waters of **Lake Baikal**, the world's deepest lake situated in **Siberia**.

- The construction of this telescope, which started in 2016, is motivated by the mission **to study in detail the elusive fundamental particles called neutrinos** and to possibly determine their sources.



## Key Points

- **About Baikal-GVD Telescope:**
  - It is **one of the three largest neutrino detectors in the world** along with the **IceCube at the South Pole** and **ANTARES in the Mediterranean Sea**.
  - 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.
  - It 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:**

- The **universe is made of some fundamental particles** that are indivisible. These **particles can be classified into quarks and leptons.**
  - But this **only applies to “normal matter”** or the matter that scientists know that 5% of the universe is made up of.
- There has been the **discovery of over 12 such quarks and leptons, but three of these (protons, neutrons and electrons) make** what is referred to as the building block of life- **the atom.**
- **Protons** (carry a **positive charge**) and **neutrons (no charge)** are **types of quarks**, whereas **electrons** (carry a **negative charge**) are **types of leptons.**
- 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 mobile phone, a planet, and so on.
- Studying what humans and everything around them is made up of **gives scientists a window into understanding the universe** a better way.

#### ▪ **About Neutrinos:**

- **Neutrinos (not the same as neutrons)** are also a **type of fundamental particle.**
- Neutrinos **belong to the family of particles called leptons**, and there are **three types of neutrino**, i.e. electron-neutrino, muon-neutrino, and tau-neutrino.
- They are the **second most abundant particles, after photons**, which are particles of light.
- However, 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.**
- **Natural sources of neutrinos** include the radioactive decay of primordial elements within the earth, radioactivity in the sun, cosmic interactions in the atmosphere and others.
- 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.

### **Big-Bang Model**

- It is a widely held theory of the evolution of the universe.
- Its essential feature is the **emergence of the universe from a state of extremely high temperature and density**—the so-called big bang that occurred 13.8 billion years ago.

### **Supernova**

- Supernova is a **powerful and luminous stellar explosion.**
- This astronomical event **occurs during the last evolutionary stages of a massive star** or when a **white dwarf** is triggered into runaway nuclear fusion.

### **Quarks**

- Quark is a fundamental constituent of matter and is defined as an elementary particle.
- The quarks combine to produce composite particles called **hadrons**, the most stable of which are **neutrons and protons** that are the components of atomic nuclei.

### **Lepton**

- Lepton, any member of a class of subatomic particles that **respond only to the electromagnetic force, weak force, and gravitational force.**
- They are not affected by the strong force.
- Leptons are said to be elementary particles; and **can either carry one unit of electric charge or be neutral.**

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