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.**

Source: IE