



## Scientists to test land for LIGO

Recently the Environment Ministry has allowed scientists to test the suitability of land in Maharashtra's Hingoli district to host the ambitious Laser Interferometer Gravitational Wave Observatory (LIGO) project.

- The project involves constructing a network of L-shaped arms, each four kilometres long, which can detect even the faintest ripples from cosmic explosions millions of light years away.
- The project, piloted by the Department of Atomic Energy and Department of Science and Technology and is expected to be ready by 2025.

### LIGO India

- LIGO India is a planned advanced gravitational-wave observatory to be located in India as part of the worldwide network.
- The LIGO project operates three gravitational-wave (GW) detectors. Two are at Hanford in the State of Washington, north-western USA, and one is at Livingston in Louisiana, south-eastern USA.
- The LIGO-India project is an international collaboration between the LIGO Laboratory and three lead institutions in the LIGO-India consortium: Institute of Plasma Research, Gandhinagar; IUCAA, Pune; and Raja Ramanna Centre for Advanced Technology, Indore.

### Significance of LIGO India Project:

- Information extracted by these transmitted waves will help to address unsolved questions and mysteries of physics and astronomy.
- It will help Indian scientific community to be a major player in the emerging research frontier of GW astronomy.
- The high-end engineering requirements of the project (such as the world's largest ultra-high vacuum facility) will provide unprecedented opportunities for Indian industries in collaboration with academic research institutions.
- Multidisciplinary nature of project would provide opportunity to bring together scientists and engineers from different fields like optics, lasers, gravitational physics, astronomy and astrophysics, cosmology, computational science, mathematics and various branches of engineering.
- The cutting edge project in India can serve as a local focus to interest and inspire students and young scientists.

### What are Gravitational waves

- Gravitational waves are distortions or 'ripples' in the fabric of space-time caused by some of the most violent and energetic processes in the Universe.
- They transport energy as gravitational radiation and pass through matter without interacting with it.
- Gravitational waves were first predicted in 1916 by Albert Einstein on the basis of his Theory of General Relativity.
- Strongest sources of gravitational waves are among enigmatic objects in our universe like black holes, supernova, neutron stars and Big Bang

## Notes:

**Black Holes-** A black hole is a place in space where gravity pulls so much that even light can not get out. The gravity is so strong because matter has been squeezed into a tiny space. This can happen when a star is dying.

**Supernova-** A supernova is the explosion of a star. It is the largest explosion that takes place in space. A supernova happens where there is a change in the core, or center, of a star. A change can occur in two different ways, with both resulting in a supernova.

## Neutron stars-

- Neutron stars comprise one of the possible evolutionary end-points of high mass stars.
- Once the core of the star has completely burned to iron, energy production stops and the core rapidly collapses, squeezing electrons and protons together to form neutrons and neutrinos.
- A star supported by neutron degeneracy pressure is known as a 'neutron star', which may be seen as a pulsar if its magnetic field is favourably aligned with its spin axis.

**Big Bang-** The Big Bang Theory is the leading explanation about how the universe began. At its simplest, it says the universe as we know it started with a small singularity, then inflated over the next 13.8 billion years to the cosmos that we know today.

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