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ANITA - Antarctic Impulsive Transient Antenna

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

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 Guren 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 back to their original source.
- 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.

SERS Sensing

- Institute of Nano Science and Technology (INST) has developed a hybrid Surface-Enhanced Raman Spectroscopy (SERS) platform of Molybdenum disulfide (MoS₂, an inorganic compound) nanostructure decorated with gold Nanoparticles (AuNPs).
- SERS is a commonly used sensing technique in which inelastic light scattering by molecules is greatly enhanced when the molecules are adsorbed onto corrugated metal surfaces such as silver or gold nanoparticles (NPs).
- SERS detection has been emerging as a powerful tool for the detection of a variety of analytes due to its very high sensitivity and fingerprinting recognition capabilities.
- This will also shed new light in the SERS sensing of biological and chemical molecules.
- The technology can be used in combination with an antibody for the spectroscopic detection of various biomarkers (an objective measure that captures what is happening in a cell or an organism at a given moment).
- The hybrid SERS platform offers controlled formation of localized hotspots for ultrasensitive and reproducible detection of analytes (substances whose chemical constituents are being identified and measured).
- This research will open a new avenue for the development of commercialized SERS substrates (a silicon wafer coated with a metal like gold or silver) with a localized detection capability of analytes.

- It enhances the Raman scattering light from molecules, thus leading to effective analysis of the molecules.

Raman Effect

- It is a phenomenon in spectroscopy discovered by the eminent physicist Sir Chandrasekhara Venkata Raman on 28th February 1928.
- Raman effect is the inelastic scattering of a photon by molecules which are excited to higher vibrational or rotational energy levels. It is also called Raman scattering.
- In simpler words, it is a change in the wavelength of light that occurs when a light beam is deflected by molecules.
- When a beam of light traverses a dust-free, transparent sample of a chemical compound, a small fraction of the light emerges in directions other than that of the incident (incoming) beam.
- Most of this scattered light is of unchanged wavelength. A small part, however, has wavelengths different from that of the incident light and its presence is a result of the Raman Effect.
- The Raman Effect forms the basis for Raman spectroscopy which is used by chemists and physicists to gain information about materials.
- Spectroscopy is the study of the interaction between matter and electromagnetic radiation.

Heat Waves

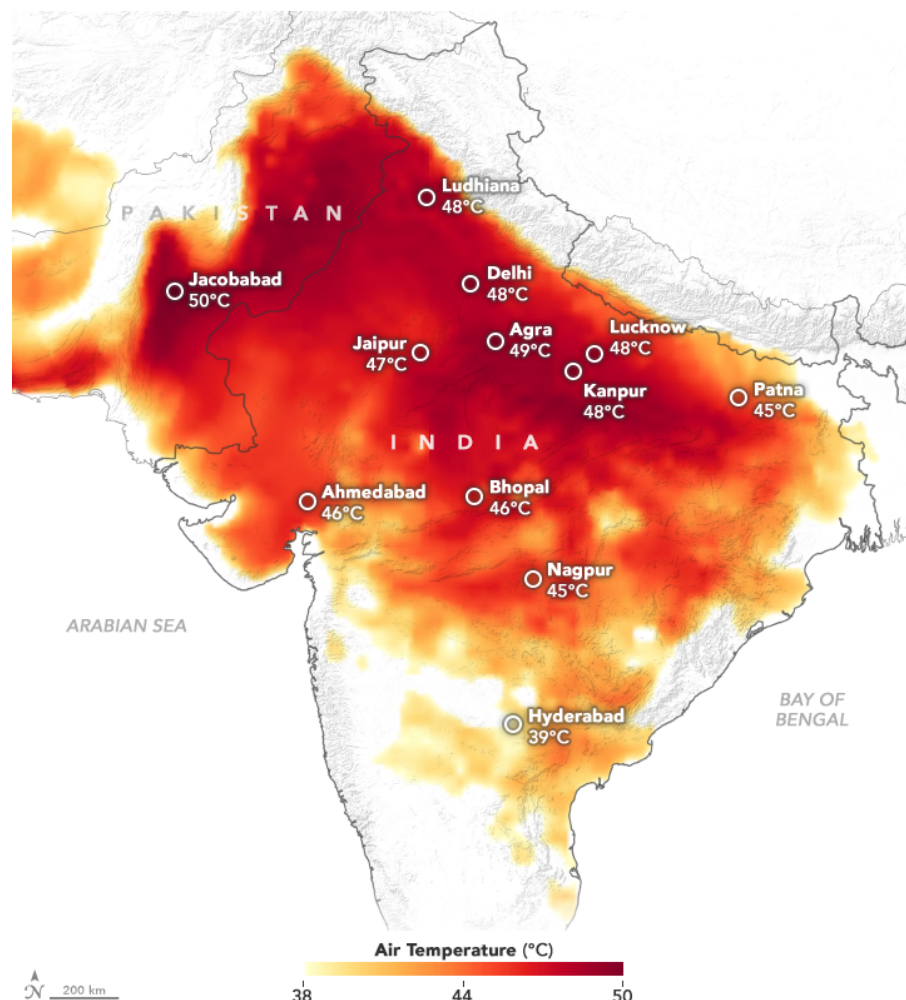
- A Heat Wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the summer season.
- Heat Waves typically occur between March and June, and in some rare cases even extend till July.
- The Indian Meteorological Department (IMD) has given the following criteria for Heat Waves:
 1. Heat Wave need not be considered till the maximum temperature of a station reaches at least 40°C for Plains and at least 30°C for Hilly regions.
 2. When the normal maximum temperature of a station is less than or equal to 40°C, Heat Wave Departure from normal is 5°C to 6°C and Severe Heat Wave Departure from normal is 7°C or more.
 3. When the normal maximum temperature of a station is more than 40°C, Heat Wave Departure from normal is 4°C to 5°C and Severe Heat Wave Departure from normal is 6°C or more.
 4. When the actual maximum temperature remains 45°C or more irrespective of normal maximum temperature, heat waves should be

declared.

- The health impacts of Heat Waves typically involve dehydration, heat cramps, heat exhaustion and/or heat stroke.
- Children, the elderly and those with pre-existing morbidities are particularly vulnerable.

Heat Waves in India

- Recently several parts of north India are reeling under an intense heatwave with many districts in Rajasthan, Haryana, Uttar Pradesh, Madhya Pradesh posting temperatures over 45 degrees Celsius or five degrees above what is normal.



- Following are reasons for prevalence of heat waves in India
 1. Magnified effect of paved and concrete surfaces in urban areas and a lack of tree cover.
 2. Urban heat island effects can make ambient temperatures feel 3 to 4 degrees more than what they are.
 3. More heat waves were expected as globally temperatures had risen by an

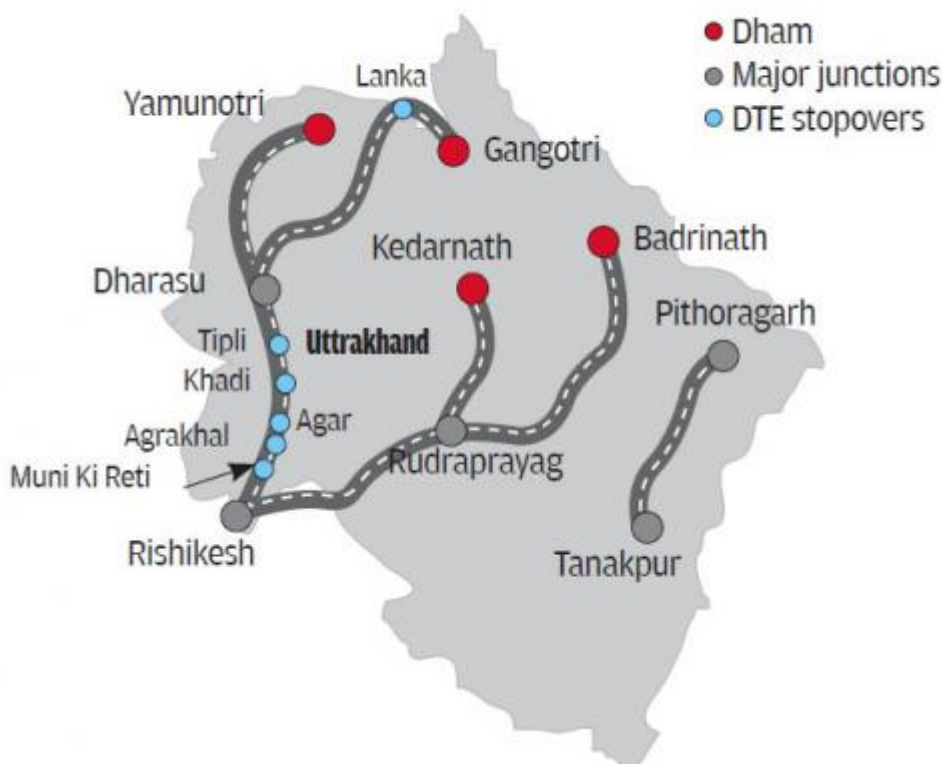
average 0.8 degrees in the past 100 years. Night-time temperatures are rising too.

4. Higher daily peak temperatures and longer, more intense heat waves are becoming increasingly frequent globally due to climate change.
5. High intensity of UV rays in medium-high heat wave zone.
6. Combination of exceptional heat stress and a predominantly rural population makes India vulnerable to heat waves.

Chardham Pariyojana

- The project involves developing and widening 900-km of national highways connecting the holy Hindu pilgrimage sites of Badrinath, Kedarnath, Gangotri, and Yamunotri at an estimated cost of Rs.12,000 crores.
- The highway will be called Char Dham Mahamarg (Char Dham Highway) and the highway construction project will be called as Char Dham Mahamarg Vikas Pariyojana (Char Dham Highway Development Project).
- The roads will be widened from 12m to 24m and the project will involve construction of tunnels, bypasses, bridges, subways and viaducts.
- It is a programme taken up by the Ministry of Road Transport and Highways.

Proposed Char Dham highway



Rishikesh-Dharasu road highway

- The Border Roads Organisation (BRO) has completed construction of a 440 m long tunnel below the Chamba town on the Rishikesh-Dharasu road highway (National Highway - 94).
- The construction of the tunnel is a part of the Chardham Pariyojana.
- Uttarakhand State Public Works Department (PWD), BRO and the National Highway & Infrastructure Development Corporation Limited (NHIDCL) are Implementing Agencies of the project.
- The work under the programme is being implemented on Engineering, Procurement and Construction (EPC) mode.

Engineering, Procurement and Construction (EPC) mode

- Under the EPC mode, the project cost is completely borne by the government.
- However, the contractor is directly responsible for ensuring quality of the work as well as rectification of defects and maintenance of the project stretch for a period of 4 years after completion of construction.

Border Roads Organization

- BRO was conceived and raised in 1960 by Pandit Jawaharlal Nehru for coordinating the speedy development of a network of roads in the North and the North Eastern border regions of the country.
- It works under the administrative control of the Ministry of Defence.
- It has diversified into a large spectrum of construction and development works comprising airfields, building projects, defence works and tunneling and has endeared itself to the people.

Dehing Patkai Wildlife Sanctuary

- Dehing Patkai wildlife sanctuary is located in the Dibrugarh and Tinsukia Districts of Assam.
- The Dehing Patkai forms the largest stretch of tropical lowland rainforests in India.
- Ethnic groups living in the area include the indigenous Assamese communities, particularly Tai Phake, Khamyang, Khampti, Singpho, Nocte, Ahom, Kaibarta, Moran and Motok, Burmese, and non-indigenous Nepali people.
- Recently concerns have been expressed over the diversion of 98.59 hectares land of Saleki proposed reserve forest, which is a part of Dehing

Patkai elephant reserve, for a coal-mining project in Upper Assam.

Source: PIB, the Hindu, Business Line, Indian Express



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