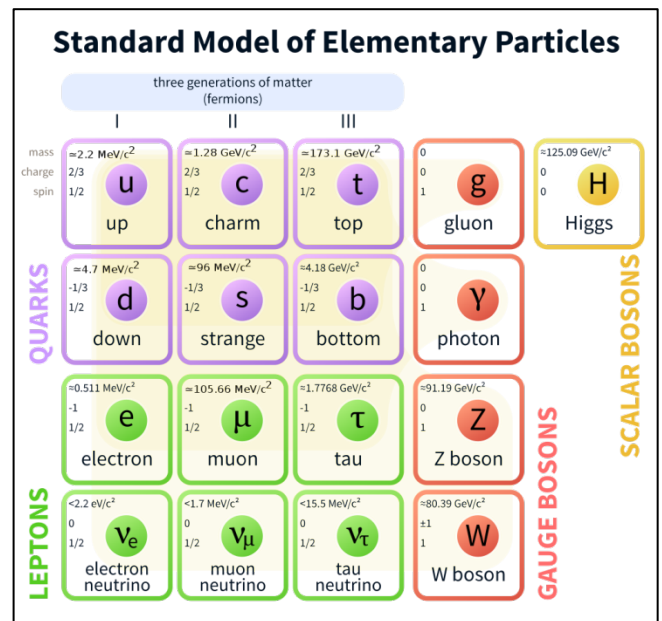


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## Neutrino Detector

**Context:** China is building the world's largest telescope in the western Pacific Ocean to detect neutrinos, often referred to as "ghost particles."

- Initially, atoms were believed to be the smallest particles until scientists revealed their **subatomic components**: **protons** (positively charged), **electrons** (negatively charged), and **neutrons** (neutral).
- **Neutrinos** are a type of **subatomic particle**, resembling electrons and neutrons in their **lack of electric charge**.
- Neutrinos are among the **most abundant yet tiniest particles** in the universe, with trillions passing through a person in any given moment.
- Previously considered massless, scientific evidence has demonstrated that **neutrinos possess a minuscule amount of mass**.
- Neutrinos are extremely **challenging to detect** due to their **weak charge** and **scarcity of interactions** with other particles.
- They earn the nickname "ghost particles" because they mostly pass through the universe without detection, as their interactions with other particles are exceptionally rare.
- **Method of Detection:**
  - Ghost particles, or neutrinos, have rare interactions with other particles but are not entirely undetectable.
  - Neutrinos are sometimes observed when they **create byproducts** after traveling through water or ice. These byproducts, known as "**muons**," **produce flashes of light**.
  - Sophisticated **underwater telescopes are capable of detecting** these light flashes, providing a way to study neutrino energy and sources.
  - The **University of Madison-Wisconsin's "IceCube" telescope is currently the largest** neutrino-detecting telescope, located in Antarctica and covering about 1 cubic kilometer.
  - **China** is constructing a new telescope named "**Trident**" in the South China Sea, which will span a vast **7.5 cubic kilometers**, making it significantly larger than existing telescopes.
  - Trident's larger size will enhance its neutrino detection capabilities, making it "**10,000 times more sensitive**" than current underwater telescopes.
  - Construction is underway, and scientists anticipate its completion within this decade.
- **Quest for detection:**
  - **Neutrinos Challenge Physics:** Neutrinos defy known laws of physics, making them intriguing subjects for scientific exploration.
  - **Cosmic Ray Origins:** Neutrinos are linked to cosmic rays, and understanding them can help uncover the origins of these mysterious high-energy particles from space.
  - **Unlocking Universe's Secrets:** Neutrinos may have played a role in the early universe, and studying them could lead to profound insights into the cosmos.
  - **Scientific Advancements:** Advanced detectors like China's "Trident" telescope improve neutrino research, potentially reshaping our understanding of the universe.
  - **Quest for Knowledge:** Detecting neutrinos reflects our curiosity and determination to uncover the universe's deepest mysteries.



## Tropical Cyclone

**Context:** IMD reported that Hamoon intensified into a very severe cyclonic storm.

- The weakening of **Cyclone Tej in the Arabian Sea** may have contributed to Hamoon's strengthening over Peninsular India in the Bay of Bengal.
- The last instance of both marginal seas of the Indian Ocean experiencing cyclones simultaneously was in **2018**, involving **Cyclones Luban and Titli**.
- According to IMD, when twin cyclonic systems like Tej and Hamoon interact, one can become stronger. In this case, Tej initially held more strength but has weakened as it moved inland, while Hamoon intensified.
- The **Sundarbans region is expected to be less affected as the system is veering away** from the West Bengal coast, with the system making landfall earlier than anticipated.
- **Features of Tropical Cyclone:**
  - Tropical cyclones form in tropical oceans between **5° to 30° latitude north or south** of the equator, where sea temperatures are at least 27°C.

## Face to Face Centres



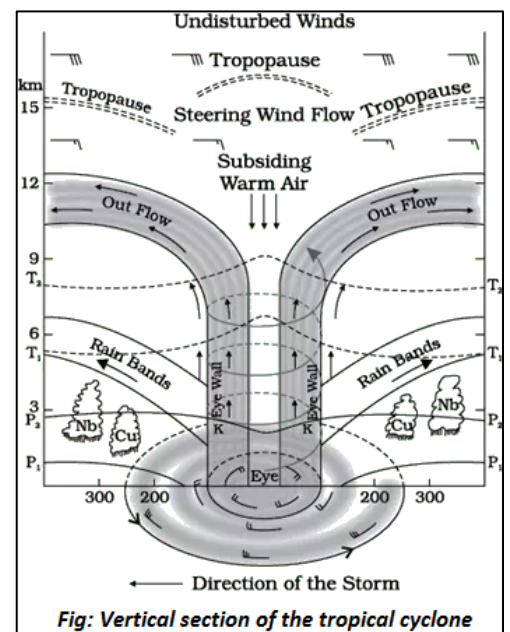


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- They **redistribute heat and energy from the equator to the poles.**
- **Low-pressure areas develop** on both sides of the equator due to warm tropical ocean air, resulting in thundery showers. These can coalesce to create cyclones.
- **Conditions for tropical cyclone formation:**
  - High sea temperatures (at least 27°C).
  - Converging winds near the ocean surface, causing rising air and storm cloud formation.
  - Low wind shear, where winds remain relatively consistent with altitude.
  - Adequate distance from the equator for the Coriolis force to influence cyclone formation.
- **Deep thunderclouds (cumulonimbus clouds) form** at an altitude of about six miles, while the eye remains cloud-free and calm.
- Cyclones **draw energy from warm ocean water**, with heat released from condensation warming the air and lowering pressure.
- Energy from the ocean sustains cyclones, but they weaken when over land.
- Only **about 3% of heat energy converts into cyclonic wind energy**, yet this is a significant power supply equivalent to half of the world's electrical generating capacity.

### ➤ Naming of cyclones in Indian Ocean

- In 2000, **WMO/ESCAP was formed with eight countries**, deciding to name cyclones in the North Indian Ocean.
- These countries submitted name suggestions, and the final list was determined by the PTC.
- In **2018, the group expanded to include five more countries.**
- The list of 169 cyclone names in 2020 came from these 13 countries, each contributing 13 suggestions.
- **Importance of Naming:**
  - Naming makes it easier to remember and identify individual cyclones.
  - Enhances awareness and facilitates rapid dissemination of warnings for preparedness.
  - Reduces confusion when multiple cyclonic systems are present.
- **Naming Rules:**
  - Names should be neutral, avoiding politics, religion, culture, and gender.
  - Names should not offend any group.
  - Names should be short, easy to pronounce, and non-offensive.
  - The name should not be rude or cruel.
  - Maximum name length is eight letters.
  - Pronunciation and voice over information should be provided.
  - Names are not repeated for cyclones over the North Indian Ocean.



## Bond Yield

**Context:** On October 23, the US 10-year government bond yield hit 5.02%, the highest since July 2007, serving as a global asset price benchmark.

- Factors contributing to this increase **include rising crude oil prices, inflation concerns, and signals from the US Federal Reserve.**
- Higher government borrowing has also played a role in driving up bond yields.
- Concerns about inflation due to higher energy prices and global uncertainties, such as the Israel-Hamas conflict, are contributing to the rise in yields.
- US Fed Chair Jerome Powell has stated that below-trend growth and labor market softening are needed for inflation to reach the 2% target.
- **Bond yield**
  - Bonds represent **loans made by investors to borrowers**, typically companies or institutions, for a **fixed period** in exchange for **regular interest payments**.
  - The **bond yield** is the **annual return** that an investor expects to receive over the bond's term to maturity.
  - For bond purchasers, the yield summarizes the total return, considering both interest payments and the bond's principal, relative to the bond's price.
  - **Bond prices in the secondary market move inversely to bond yields.** When yields rise, bond prices tend to fall, and vice versa.
  - Increasing bond yields can have a negative ripple effect on equities, impacting stock markets and investments.

## Face to Face Centres

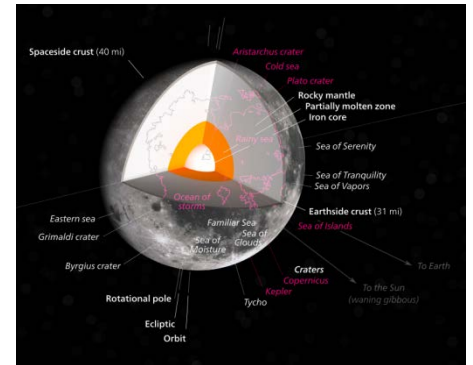




## Age of Moon

**Context:** A new analysis of samples of the Moon brought back by Apollo 17 astronauts suggest that the Moon is 40 million years older than previously thought.

- The **Moon formed over 4 billion years ago** when a Mars-sized object collided with Earth, with debates on the exact timing of this event.
- A recent study in *Geochemical Perspectives Letters* used Moon samples from Apollo 17 astronauts to gain insights into the Moon's age.
- The **research suggests that the Moon is at least 4.46 billion years old**, which is 40 million years older than previous estimates.
- Tiny crystals in the samples, formed after the lunar magma ocean cooled, were analyzed to determine the Moon's minimum age.
- The analytical method used was atom probe tomography.
- Understanding the Moon's age is crucial for comprehending Earth's history, including how the Moon stabilized Earth's rotational axis and influenced our planet's day length.
- The Moon's age may also provide insights into the early solar system and the formation of celestial bodies.



### Features of Moon

- The Moon is **Earth's natural satellite**, orbiting at an average distance of about **384,400 km (238,900 mi)**, approximately **30 times Earth's diameter**.
- **Tidally locked**, it consistently shows its near side to Earth, aligning its 29.5-day lunar month with its lunar day.
- The **Moon**, alongside the Sun, plays a crucial role in **causing tides** on Earth due to gravitational forces.
- The Moon is considered a **planetary-mass object**, with **1.2% of Earth's mass** and a diameter about one-quarter of Earth's (approximately 3,474 km or 2,159 mi).
- Among the Solar System's moons, it is the **most massive in relation to its parent planet and the fifth most massive overall**.
- The Moon has about one-sixth of Earth's surface **gravity**, roughly half that of Mars, and is the **second-highest among all Solar System moons**, only surpassed by Jupiter's moon, Io.
- It's a **terrestrial body** with **no significant hydrosphere**, atmosphere, or **magnetic field**, forming around 4.51 billion years ago from **debris resulting from a collision between Earth and a hypothetical Mars-sized object called Theia**.
- The lunar surface features **mountains, impact craters, lunar dust, ray-like streaks, and dark plains known as maria**, primarily found on the near side.
- The maria were formed when large impacts on the Moon's far side heated lower crust layers on the near side.
- The Moon is **always illuminated by the Sun except during lunar eclipses**, and its visible illumination changes throughout its orbit, producing lunar phases.
- It's the brightest celestial object in Earth's night sky, thanks to its size and **reflectance, nearly equal to asphalt**.
- The Moon's apparent size is close to that of the Sun, enabling it to cover the Sun during a total solar eclipse.
- Due to cyclical shifts in perspective (libration), about **59% of the lunar surface is visible** from Earth over time.
- The Moon has played a significant role in various aspects of human culture, including cosmography, mythology, religion, art, timekeeping, natural science, and space exploration.
- **Human-made objects reached the Moon in 1959**, with **Luna 2 from the Soviet Union**, and **soft landings** and orbital insertions were achieved in **1966**.
- In **1969**, **humans** first landed on the Moon during the Apollo 11 mission, and subsequent missions occurred until 1972.
- Lunar exploration has continued robotically, with plans for crewed missions to return starting in the late 2020s.

## NEWS IN BETWEEN THE LINES

### Death Valley National Park



Recently, a massive temporary lake formed at Badwater Basin salt flats in Death Valley National Park, California, due to flooding from Tropical Storm Hilary in August.

**About the Death Valley National Park:**

- Death Valley National Park straddles the **California-Nevada border**, east of the **Sierra Nevada mountain range**.
- It encompasses Death Valley, **Panamint Valley**, **Eureka Valley** and **Saline Valley**.
- The park lies at the interface of the Great Basin and Mojave deserts, featuring a diverse environment with **salt flats, sand dunes, valleys, canyons** and mountains.
- It is the largest national park in the contiguous United States.
- The park is home to various plant and animal species adapted to the harsh desert environment, including creosote bushes, **Joshua trees, bighorn sheep, coyotes** and the endangered Death Valley pupfish.
- UNESCO designated Death Valley as a part of the **Mojave and Colorado Deserts Biosphere Reserve in 1984**.
- Death Valley National Monument was declared in **1933**, and it became a national park in **1994**.

## Face to Face Centres





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## Aadi Mahotsav



Today, Union Minister for Tribal Affairs would be inaugurating the Aadi Mahotsav, the National Tribal Festival at Ahmedabad, Gujarat.

### About Aadi Mahotsav:

- Aadi Mahotsav is a mega event organized by the Tribal Cooperative Marketing Development Federation of India Limited (TRIFED).
- It serves as a unique bridge to explore India's indigenous heritage and tribal culture.
- It includes attractions such as handicrafts, handloom, pottery, jewelry and the exhibition of millets grown by tribals.

### About TRIFED:

- Tribal Cooperative Marketing Development Federation of India Limited (TRIFED) is a national-level organization under the Ministry of Tribal Affairs.
- Its primary focus is on developing and marketing tribal handicrafts and natural products.
- It was established in 1987 and registered under the Multi-State Cooperative Societies Act, 1984 (now the Multi-State Cooperative Societies Act, 2002).
- Its headquarters is located in New Delhi.

## Osage Indian Tribe



### About the Osage India Tribe:

- The Osage Indians were a Native American tribe primarily located in Oklahoma in the United States.
- In the 1920s, the Osage tribe became wealthy due to the discovery of oil on their land.
- Members received "headrights," which were shares in the tribe's mineral trust, linked to oil royalties.
- Many Osage people were assigned white "financial guardians" who controlled their finances, limiting their access to wealth.
- A series of murders occurred among the Osage tribe in the 1920s, with many members being poisoned, shot or killed mysteriously.
- The Bureau of Investigation (predecessor to the FBI) expanded in the 1920s.

## Thallium



Recently, a shocking case emerged in Maharashtra, where an agricultural scientist used Thallium to kill her husband and four in-laws.

### About Thallium:

- Thallium is globally known as the "poisoner's poison" due to its extreme toxicity.
- Sir William Crookes discovered thallium in 1861.
- It is found in trace amounts in the Earth's crust.
- It belongs to the main Group 13 (IIIA, or boron group) of the periodic table.
- It was historically used as a rodenticide, primarily for pest control.

### Properties:

- Thallium is tasteless and odorless, making it a stealthy poison.
- It is a soft, heavy metal with low tensile strength.
- It does not dissolve in water but dissolves slowly in hydrochloric acid and dilute sulfuric acid, rapidly in nitric acid.

### Applications:

Thallium is used in manufacturing of electronics, low-temperature thermometers, optical lenses and imitation precious jewels.

## Quantum Chaos



### About Quantum Chaos:

- Quantum chaos is a branch of quantum physics that explores the behavior of systems that exhibit chaotic dynamics in the quantum realm.
- Quantum chaos, like classical chaos, is characterized by deterministic chaos. It means that precise predictions of the system's behavior are possible only if the initial conditions are known with a high degree of accuracy.
- In quantum chaos, researchers often study Rydberg atoms, which are atoms excited to high energy levels.

### Applications:

Quantum chaos research has gained significant interest due to its applications in various fields, including thermalization, quantum information and understanding the quantum mechanics of black holes.

## Ball Lightning



### About the Ball Lightning:

- Ball lightning is one of the rare and mysterious forms of lightning characterized by a luminous, ball-shaped appearance.
- Ball lightning typically appears near the point of a lightning strike and moves horizontally at a slow speed, usually a few centimeters per second.
- It can pass through closed windows, emits a hissing sound and has a lifespan of several seconds.
- The color of ball lightning varies and it often ends with an explosion.
- It is usually not destructive, despite its enigmatic properties.
- It is also referred to as "globe lightning."
- It is associated with intense electrical activity in the atmosphere.
- These luminous balls are believed to be plasmas, which are ionized states of matter with positive and negative ions moving freely.

## Face to Face Centres





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## Place in News

## Orkney Islands

Recently, archaeologists have made an extra ordinary discovery in Orkney, uncovering the remains of a 5,000-year-old tomb.

### About Orkney Islands:

- Orkney Islands are an **archipelago** situated approximately 10 miles off the **north coast of Scotland**.
- The archipelago comprises **70** individual islands, with only **20 of them being inhabited**.
- They are home to numerous **archaeological sites**, including **Neolithic** stone circles and chambered tombs, such as **Maeshowe**.
- The "**Heart of Neolithic Orkney**" is a **UNESCO World Heritage site**, comprising four significant Neolithic monuments: the **Ring of Brodgar**, **Stones of Stenness**, **Maeshowe** and **Skara Brae**.

### Archipelago:

- An archipelago is a **group or chain of islands** closely scattered in a body of water, such as a **sea, ocean, lake** or river.
- These islands are typically **formed through geological processes** like **volcanic activity, tectonic movements** or **sediment accumulation**.



## POINTS TO PONDER

- ❖ Recently, CBI's hunt for cyber-enabled financial frauds was called? - **Operation Chakra-2**
- ❖ Site directed Nucleases Technology is related to which field of Technology? - **Genome Editing**
- ❖ Dhanauri Wetland, recently seen in the news, is located in which state? - **Uttar Pradesh**
- ❖ Ecomark Scheme, recently in the news, has been launched by which ministry? - **Ministry of Environment, Forest and Climate Change**
- ❖ A new species of dragonfly, Red-humped hawklet is discovered in which region? - **Western Ghats**

## Face to Face Centres

