1. **Axiom-4 Mission**: Group Captain Shukla will become the **first Indian astronaut** to go to the **International Space Station (ISS)** and the first Indian to go to space in the last 40 years.
   - **About:** Axiom Mission 4 (Ax-4) is a **private mission** to the **International Space Station (ISS)**.
     - Conducted by **Axiom Space** using a **SpaceX Crew Dragon spacecraft**.
     - **Collaboration:** In partnership with **NASA**, marking the **fourth Axiom Space mission** after Ax-1, Ax-2, and Ax-3.
   - **Mission Objectives:**
     - **Commercial Space:** Supports **research, technology, and tourism**.
     - **Global Collaboration:** Involves **astronauts from multiple nations**.
     - **R&D:** Conducts **microgravity experiments** in various fields.
   - **About International Space Station (ISS):** Launched in **1998**, allowing **modular expansion and flexibility**.
     - **Purpose:** Conducts research in **astrobiology, astronomy, meteorology, and physics**.
     - **Largest Artificial Object in Space:** At altitude of 400 km above Earth.
     - **First Crew Arrival: November 2, 2000**.
   - **Collaborative Project** involving **five major space agencies**: **NASA (USA)**, **Roscosmos (Russia)**, **JAXA (Japan)**, **ESA (Europe)** & **CSA (Canada)**
   - **Two Segments of the ISS: Russian Orbital Segment (ROS) -** Managed by **Russia**.
     - **United States Orbital Segment (USOS):** Managed by **USA & partner nations**.
   - **Governance:** Established through the **Intergovernmental Agreement (IGA)** and **Memoranda of Understanding (MoUs)**, these agreements between **NASA and other space agencies** were signed on **January 29, 1998**.
2. **INSV Tarini & Point Nemo:** The INSV Tarini recently crossed **Point Nemo on January 30** during the **Navika Sagar Parikrama-II** expedition.
   - **About Point Nemo:** Located in the **South Pacific**, it is the **Oceanic Pole of Inaccessibility**, the most **remote location on Earth**, **2,688 km from the nearest landmass**.
     - Collected **vital water samples** for analysis by the **National Institute of Oceanography**, contributing to **oceanographic research**.
     - **Spacecraft Cemetery:** Point Nemo is used as a **decommissioned spacecraft cemetery**,

- -where defunct satellites and stations are deliberately deorbited.
- **Historic Significance:** The **Spanish vessel Hespérides (1999)** was the **first ship to sail to Point Nemo**. INSV Tarini crossed it **purely on sails**.

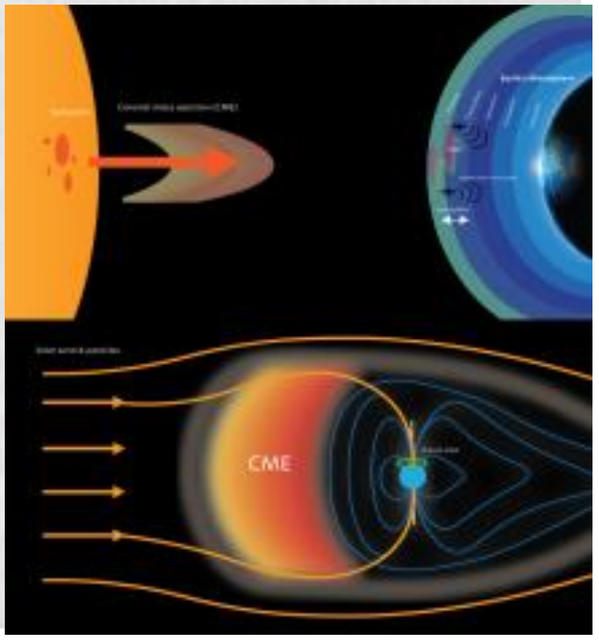
- **About INSV Tarini:** It is **sailing vessel**, built by **Aquarius Shipyard Ltd.**, **inducted into the Indian Navy on February 18, 2017**.

3. **Forever Chemicals:** A new study revealed that the fur of polar bears contains an oily substance that helps them remain dry despite the creatures sliding on ice and diving into the water to hunt.



- **About the key findings:** It could help develop **natural alternatives** to **Per- and polyfluoroalkyl substances (PFAs)**, also known as **"forever chemicals."**
- **Key Observations: Unwashed fur samples** contained **sebum similar to fluorinated ski skins**, which help skis grip ice.
  - **Fluorinated ski skins contain PFAs**, widely used in **nonstick cookware, water-repellent clothing, and grease-resistant products.**
  - PFAs **do not break down easily** and are linked to **decreased fertility and developmental effects in children**.
- **Composition Analysis: Fur sebum lacks squalene**, a substance dominant in **human sebum**.
  - Contains **cholesterol and other fatty acids** (possibly unique to **polar bears**, but further studies are needed).
- **Significance:** Findings could aid in designing **natural, environmentally friendly coatings** to **reduce PFA dependence**.
- **About Polar Bears: Largest carnivorous land mammals** on Earth.
  - The **only bear species classified as marine mammals**, as they rely on **Arctic sea ice** for food and habitat.
- **Distribution:** Mostly found **north of the Arctic Circle** up to the **North Pole**.
  - Some populations exist **south of the Arctic Circle**, e.g., **Hudson Bay, Canada**.
  - Inhabit **Alaska, Canada, Russia, Greenland, and Norway's northern islands (Svalbard).**
- **Conservation Status:** IUCN Red List – Vulnerable & CITES - Appendix II

4. **PM-JANMAN:** The Ministry of Rural Development recently sanctioned 27 roads of apx 50 km in Maharastra under Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan (PM-JANMAN).
   - **About the sheme:** Launched by the Ministry of Tribal Affairs (MoTA) on 15th November 2023 at Khunti District, Jharkhand, on Janjatiya Gaurav Divas.
     - **Objective**: Provide **PVTG households and habitations** with essential facilities such as **housing, drinking water, education, healthcare, road & telecom connectivity, electrification, and sustainable livelihoods** within **three**
     - **Beneficiaries**: Covers **PVTG communities** in **18 states and 1 Union Territory** across India.
   - **About Particularly Vulnerable Tribal Groups (PVTGs):** They are the most vulnerable among tribal groups in India.
     - Currently, there are 75 PVTGs among 705 Scheduled Tribes (2011 Census).
     - PVTGs are found across 18 states and one Union Territory (Andaman & Nicobar Islands).
     - Odisha has the highest number of PVTGs (over 2.5 lakh).
     - The **Ministry of Tribal Affairs** implements the **'Development of Particularly Vulnerable Tribal Groups (PVTGs)'** schemes with **100% centrally sponsored**.
5. **Coronal Mass Ejections (CMEs):** A novel method has been found to determine the instantaneous expansion speed and radial size of Coronal Mass Ejections (CMEs) from the Sun when it passes over a spacecraft at a single-point in the interplanetary medium.
   - It governs **CME longevity** and **geomagnetic storm duration**, impacting Earth's **communication systems**.
   - **About CMEs: Magnetized plasma bubbles** from the Sun that cause **geomagnetic storms**, disrupting **communications, satellites, and power grids**.
     - **CME Expansion in Space**: Expansion due to **pressure differences** with the solar wind affects their **radial dimension**, which has been inadequately studied.
     - **Existing Measurement Limitations**: Previous **single-point in situ methods** are insufficient to estimate **instantaneous expansion speed**.



- **New Non-Conventional Approach**: Developed by **Indian Institute of Astrophysics (IIA)** under the **Department of Science and Technology (DST)**.
- **Infers accelerations** of CME substructures (leading edge, center, and trailing edge) from **single-point observations**.
  - Uses **propagation speed of any two substructures** to determine **instantaneous expansion speed**.
  - Computes **radial size and distance traveled** by CME substructures at various points.
- **Case Study**: Demonstrated on a **CME from April 3, 2010**, using data from NASA & ESA **SOHO, STEREO, and Wind spacecraft**.
- **Key Findings**: CME **substructures evolve differently** due to varying forces.
  - CME's **aspect ratio first increases**, remains constant, then decreases in interplanetary space.
- **Future Applications**: Method to be tested using **Aditya Solar Wind Particle Experiment (ASPEX)** on **Aditya-L1, India's first space-based solar observatory**.
  - Helps in **accurate prediction of CME arrival time** and its effects on space weather.

6. **Bennu Sample**: Scientists have recently revealed that these rocks contain key components of life - Amino acids, nucleobases and traces of ancient saltwater — the essential ingredients for biological processes.
   - **About OSIRIS-REx Mission Key Findings: Uncovered pristine organic molecules**, offering insights into how life's chemistry may have formed in the solar system.
     - **Bennu, a relic from the dawn of the solar system**, contained **organic molecules and minerals** that may have shaped life's chemistry.
     - The mission **successfully returned samples from Bennu to Earth in 2023**.
   - **Cosmic Time Capsule: Bennu samples contain the highest concentration** of extraterrestrial **life-supporting compounds ever brought to Earth**.
   - **Asteroids like Bennu provide snapshots** of **solar system conditions from 4.5 billion years ago**.
     - These samples help to understand **the ingredients that existed before life started on Earth**.
   - **Key Organic Discoveries:** The samples contain **14 of the 20 amino acids** needed to **build proteins**.

- They also have **all five nucleobases** required for **DNA and RNA**.

- **Unusual finding:** Life on Earth **mostly uses left-handed amino acids**, but **Bennu has equal amounts of left- and right-handed ones**.
- **Presence of ammonia and formaldehyde**, which can **form more complex molecules**, supports asteroids as potential **incubators of prebiotic chemistry**.
- **Water: The Crucial Ingredient:**
  - **Bennu's samples contain traces of water** in the form of **mineral salts**.
  - Scientists detected **11 different evaporite minerals**, including **calcite, halite, sylvite, and trona** (first identified in an extraterrestrial sample).
  - These minerals suggest **Bennu once had briny water** that **evaporated over thousands or millions of years**.
  - Similar **salty water exists on Saturn's moon Enceladus** and **the dwarf planet Ceres**.
  - This strengthens the theory that **watery environments were widespread in the early solar system**, facilitating **chemical reactions leading to life**.

7. **Sleeping Sickness:** The World Health Organization (WHO) has recently announced that Guinea has successfully eliminated the gambiense form of human African trypanosomiasis (HAT), also known as sleeping sickness.
   - **About Human African Trypanosomiasis (HAT):** It is a parasitic disease transmitted by **infected tsetse flies**.
     - Symptoms include **fever, headaches, joint pain**, and later **neurological issues** like **confusion, disrupted sleep, and behavioral changes**.
     - **If left untreated, HAT can be fatal**, In the **1990s, HAT resurfaced in Guinea's coastal areas**, near **Conakry**, due to **human activity in mangroves**.
     - Guinea joins **seven other countries** that have **eliminated the gambiense form of HAT**: **Togo, Benin, Côte d'Ivoire, Uganda, Equatorial Guinea, Ghana, and Chad**.
   - **About WHO**: Established in **1948**, is a **UN specialized agency** that promotes health, ensures global safety, and supports vulnerable populations.