Support Centre for Aditya-L1

Why in News

ARIES facility (**Aryabhata Research Institute for Observational Sciences**) will **host the support centre** for **Aditya-L1 mission**, which is due **to be launched next year (2022).**

- **ARIES** is an **autonomous institute under the Department of Science & Technology** and is located in **Nainital (Uttarakhand).**

Key Points

- **About Aditya-L1 Mission:**
  - It is **India's first scientific expedition to study the Sun.** It will be **ISRO's(Indian Space Research Organisation) second space-based astronomy mission after** AstroSat, which was launched in 2015.
  - ISRO categorises Aditya L1 as a **400 kg-class satellite** that will be launched using the **Polar Satellite Launch Vehicle (PSLV)** in XL configuration.
    - It **will be inserted in a halo orbit around the L1 (Lagrangian point 1)**, which is **1.5 million km from the Earth.**
  - The space-based observatory **will have seven payloads** (instruments) on board to **study the Sun's corona, solar emissions, solar winds and flares, and Coronal Mass Ejections (CMEs)**, and will carry out **round-the-clock imaging of the Sun.**
- **Aditya-L1 Support Centre (ASC):**
  - **The main aim of this centre** is to let every researcher in India perform analysis over scientific **data obtained from Aditya-L1.** It will **expand the visibility of Aditya-L1 beyond India** at the international level.
  - It will **host a compendium of the location** and duration of different features on the solar surface such as **coronal holes, prominences, flares, CMEs and** sunspots**.**
    - **Continuous monitoring of the location** and duration of these features will **help in monitoring the Earth** directed CMEs and thereby, the **space weather.**
- **Challenges in Launching the Mission:**
  - The distance of the **Sun from Earth (approximately 15 crore kms** on average, compared to the **only 3.84 lakh kms to the Moon)**. This huge distance poses a **scientific challenge.**
  - **Aditya L1 will have some moving components** which increases the **risks of collision.**
    - Due to the risks involved, **payloads in earlier** ISRO **missions** have largely remained stationary in space.
  - Other issues are the super hot temperatures and radiation in the solar atmosphere.
    - However, **Aditya L1 will stay much farther away**, and the heat is not expected to be a major concern for the instruments on board.
- **Importance of Studying the Sun:**

    - Every planet, including Earth and the **exoplanets** beyond the Solar System, evolves and this evolution is governed by its parent star.
    - **Sun affects the weather** of the entire system.
        - Variations in this weather can change the orbits of satellites or shorten their lives, interfere with or damage onboard electronics, and cause power blackouts and other disturbances on Earth.
    - To learn about and track **Earth-directed storms**, and to predict their impact, continuous solar observations are needed.
- **Other Missions to Sun:**
    - **Japan's Solar-C EUVST:** The EUVST (Extreme Ultraviolet High-Throughput Spectroscopic Telescope Epsilon) would be studying the **solar wind** released by the **solar atmosphere**, as well as studying how this atmosphere **drives solar material eruption.**
    - **NASA's EZEI Mission:** The EZEI (Electrojet Zeeman Imaging Explorer) Mission would study the atmosphere of the earth and electric currents in it, which link the **aurora to the** magnetosphere**.**
    - **NASA**'s **Parker Solar Probe's** aim is to trace how energy and heat move through the **Sun's corona** and to study the source of the solar wind's acceleration.
        - It is part of **NASA's 'Living With a Star' programme** that explores different aspects of the **Sun-Earth system.**
    - The earlier **Helios 2 solar probe, a joint venture between** NASA and space agency of erstwhile **West Germany**, went within **43 million** km of the **Sun's surface in 1976.**

Sun's Corona

- Corona is **a luminous envelope of plasma** that surrounds the Sun and other celestial bodies.
- It is extended to millions of kilometres into space and is commonly **seen during a total solar eclipse.**
- The corona of the Sun is much hotter than its visible surface.
    - The intense temperature of the Sun's corona is due to the **presence of highly ionized ions** which give it a spectral feature.

Solar Winds and Flares

- The **solar wind** is a continuous stream of charged particles that flows out of the Sun in all directions.
- The strength of the solar wind varies depending on the activity on the surface of the Sun.
- The Earth is mostly protected from the solar wind by its strong magnetic field.
    - However, some types of activity, **like solar flares**, can cause high energy particles to emit from the Sun which can be dangerous to astronauts and can cause damage to satellites orbiting Earth.

Coronal Mass Ejection

- A **Coronal Mass Ejection (CME)** is a significant release of plasma and accompanying magnetic field from the solar corona.
- They often follow solar flares and are normally present during a solar prominence eruption.
    - **Prominences** are clouds of incandescent, ionized gas ejected from the Sun's surface.
- The plasma is released into the solar wind, and can be observed in coronagraph imagery.
- An ARIES team has recently developed an algorithm to study the accelerating solar eruptions in the lower corona called **CMEs Identification in Inner Solar Corona (CIISCO).**

Lagrangian Point 1

- Lagrange Points, named after Italian-French mathematician Josephy-Louis Lagrange, are positions in space where the gravitational forces of a two-body system (like the Sun and the Earth) produce enhanced regions of attraction and repulsion.
- These can be used by spacecraft to reduce fuel consumption needed to remain in position.
- L1 refers to Lagrangian/Lagrange Point 1, one of 5 points in the orbital plane of the Earth-Sun system.
- The L1 point is about 1.5 million km from Earth, or about 1/100th of the way to the Sun.
- A Satellite placed in the halo orbit around the Lagrangian point 1 (L1) has the major advantage of continuously viewing the Sun without any occultation/**eclipses**.
- The L1 point is home to the Solar and Heliospheric Observatory Satellite (SOHO), an international collaboration project of **National Aeronautics and Space Administration (NASA)** and the European Space Agency (ESA).

Source: TH