Aditya L1 Mission

Why in news?

The Indian Space Research Organisation (ISRO) has recently released the images of Aditya L1 mission.

What is Aditya L1 Mission?

> *Aditya L1 shall be the first space based Indian mission to study the Sun.*

- **Aim-** To observe the Sun from a close distance, and try to obtain information about its atmosphere and magnetic field.
- **Payloads-** It is equipped with 7 payloads on board to study the
  - Photosphere, Chromosphere
  - Sun's corona, solar emissions, solar winds and flares
  - Coronal Mass Ejections (CMEs)
- **Detectors-** It will carry out round-the-clock imaging of the Sun using electromagnetic and particle and magnetic field detectors.
- **Halo orbit-** The spacecraft shall be placed in a halo orbit around the ***Lagrange point 1 (L1)*** of the Sun-Earth system, which is about 1.5 million km from the Earth.
- Aditya L1 will perform continuous observations looking directly at the Sun.

What are the objectives of the mission?

- **Study**- Solar upper atmospheric (chromosphere and corona) dynamics.
- Chromospheric and coronal heating, physics of the partially ionized plasma, initiation of the coronal mass ejections, and flares
- **Observe**- The in-situ particle and plasma environment providing data for the study of particle dynamics from the Sun.
- Physics of solar corona and its heating mechanism.
- Diagnostics of the coronal and coronal loops plasma: Temperature, velocity and density.
- Development, dynamics and origin of CMEs.
- **Identify**- The sequence of processes that occur at multiple layers which eventually leads to solar eruptive events.
- Magnetic field topology and magnetic field measurements in the solar corona.
- The origin, composition and dynamics of solar wind.

What is the importance of placing the satellite in L1?

- **Lagrange points** - Lagrange points are positions in space where objects sent there tend to stay put.
- At Lagrange points, the *gravitational pull of two large masses precisely equals the centripetal force required for a small object* to move with them.
- These points in space can be used by spacecraft to reduce fuel consumption needed to remain in position.
- Of the five Lagrange points, three are unstable *(L1, L2 and L3)* and two are stable *(L4 and L5).*
- **Importance of L1 -** The L1 point is about 1.5 million km from Earth, or about one-hundredth of the way to the Sun
- A satellite placed in the halo orbit around L1 of the Sun-Earth system has the major advantage of ***continuously viewing the Sun without any occultation/eclipses.***

Lagrange point	Home to
L1	Solar and Heliospheric Observatory Satellite SOHO
L2	Was the home to the WMAP spacecraft Current home of Planck Future home of the James Webb Space Telescope

Why is studying the sun important?

The science of studying the Sun and its influence throughout the solar system is called heliophysics.

- **Source for survival**- The ultimate source of energy for the Earth is nothing else but the sun.
- Without the sun life on Earth would not exist. It would be so cold that no living thing would be able to survive and our planet would be completely frozen.
- **Parent star-** The evolution of every planet, including Earth and the exoplanets beyond the Solar System is governed by its parent star.
- **Solar weather -** The solar weather and environment affect the weather of the entire system.
- The variations in solar weather are
    - It can change the orbits of satellites or shorten their lives.
    - It interfere with or damage onboard electronics, and cause power blackouts and other disturbances on Earth.
    - Knowledge of solar events is key to understanding space weather.
- **Solar storms-** Continuous solar observation is needed as it is important to learn about and track Earth-directed storms.
- Every storm that emerges from the Sun and heads towards Earth passes through L1.
- **To study universe**- The sun is a normal star that is much closer to us than any other star, and by studying the sun, we can learn more about other stars.
- The better we understand other stars, the more we know about the Milky Way. From there we know more about other galaxies and in the end we learn more about the

universe.

- **Gravity**- Sun creates gravity that keeps our planet and the other planets of the solar system in a small space, without this our planet would simply fly.

INTERNATIONAL MISSIONS TO SUN			
Mission	**Aim**	**Country**	**Year**
Helios 1 and 2	To study the solar wind from an orbit carrying the spacecraft inside Mercury's orbit.	US & Germany	1970
Pioneer 9	To measure solar wind and solar magnetic field)	U.S	1983
SOHO	Investigation of Sun's core, corona, and solar wind; comet discoveries	Europe & U.S.	1995
Yohkoh	To observe the solar flares at X-ray wavelengths	Japan	1991
Hinode	Exploring the Sun's magnetic field and outer atmosphere	Japan	2006
Solar Terrestrial Relations Observatory (STEREO) mission	To capture unseen images of Sun	U.S.	2006
Interface Region Imaging Spectrograph (IRIS)	To study the solar atmosphere.	U.S.	2013
Parker solar probe	To unlock the mysteries of the Sun's corona and solar wind.	U.S.	2018
Aditya L1	Solar corona observation	India	Yet to be launched

References

1. Indian Express-What is ISRO Aaditya L1 Mission
2. ISRO- About Aaditya L1 Mission
3. NASA- Why to study sun

SHANKAR IAS PARLIAMENT
Information is Empowering