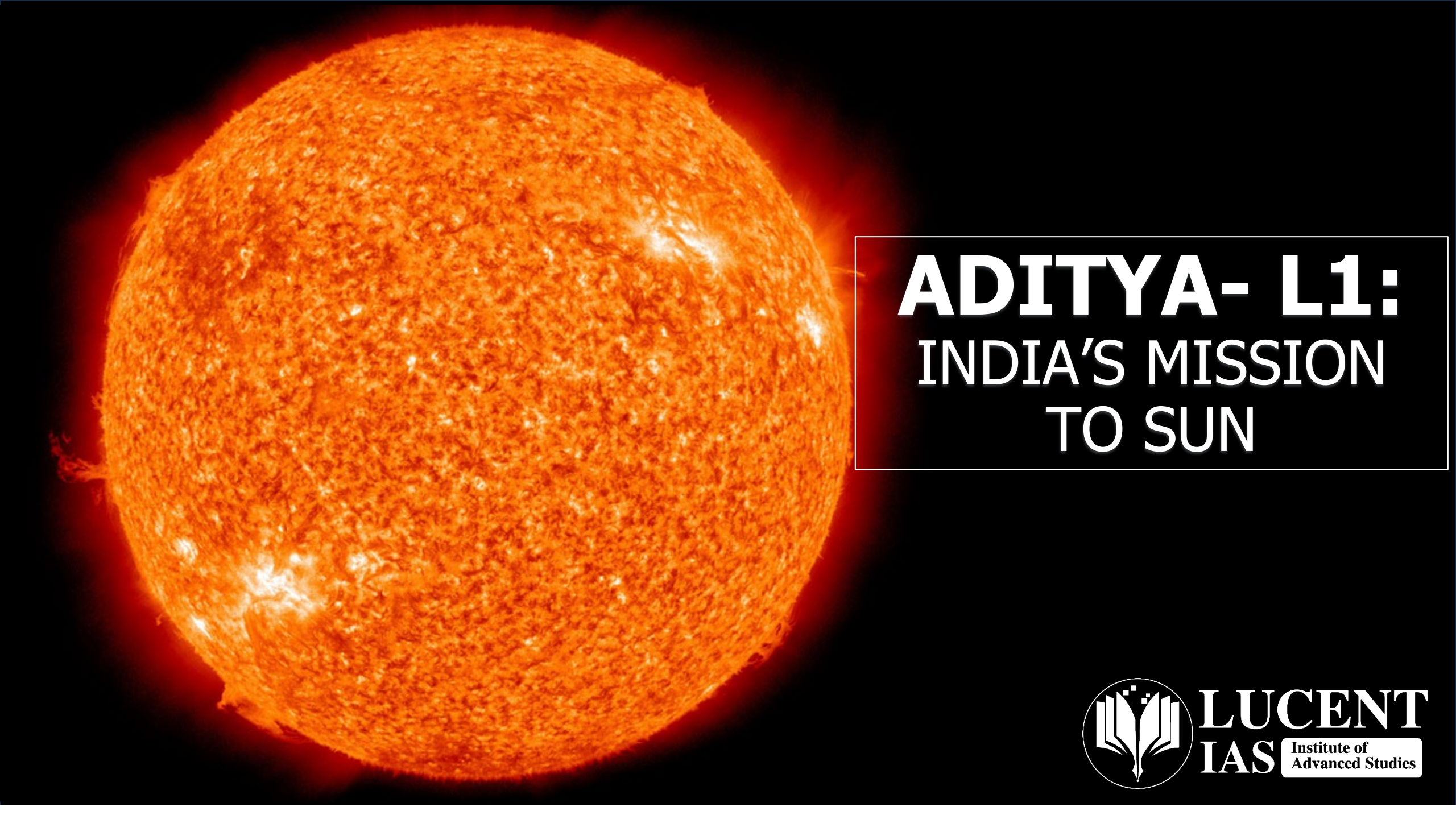


ADITYA- L1:
INDIA'S MISSION TO SUN

LUCENT IAS Institute of Advanced Studies

WHAT IS ADITYA L1 MISSION

- It shall be the first space based Indian mission to study the Sun.
- 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.
- A satellite placed in the halo orbit around the L1 point has the major advantage of continuously viewing the Sun without any occultation/eclipses. This will provide a greater advantage of observing the solar activities and its effect on space weather in real time.
- The spacecraft carries seven payloads to observe the photosphere, chromosphere and the outermost layers of the Sun (the corona) using electromagnetic and particle and magnetic field detectors.

ABOUT THE MISSION

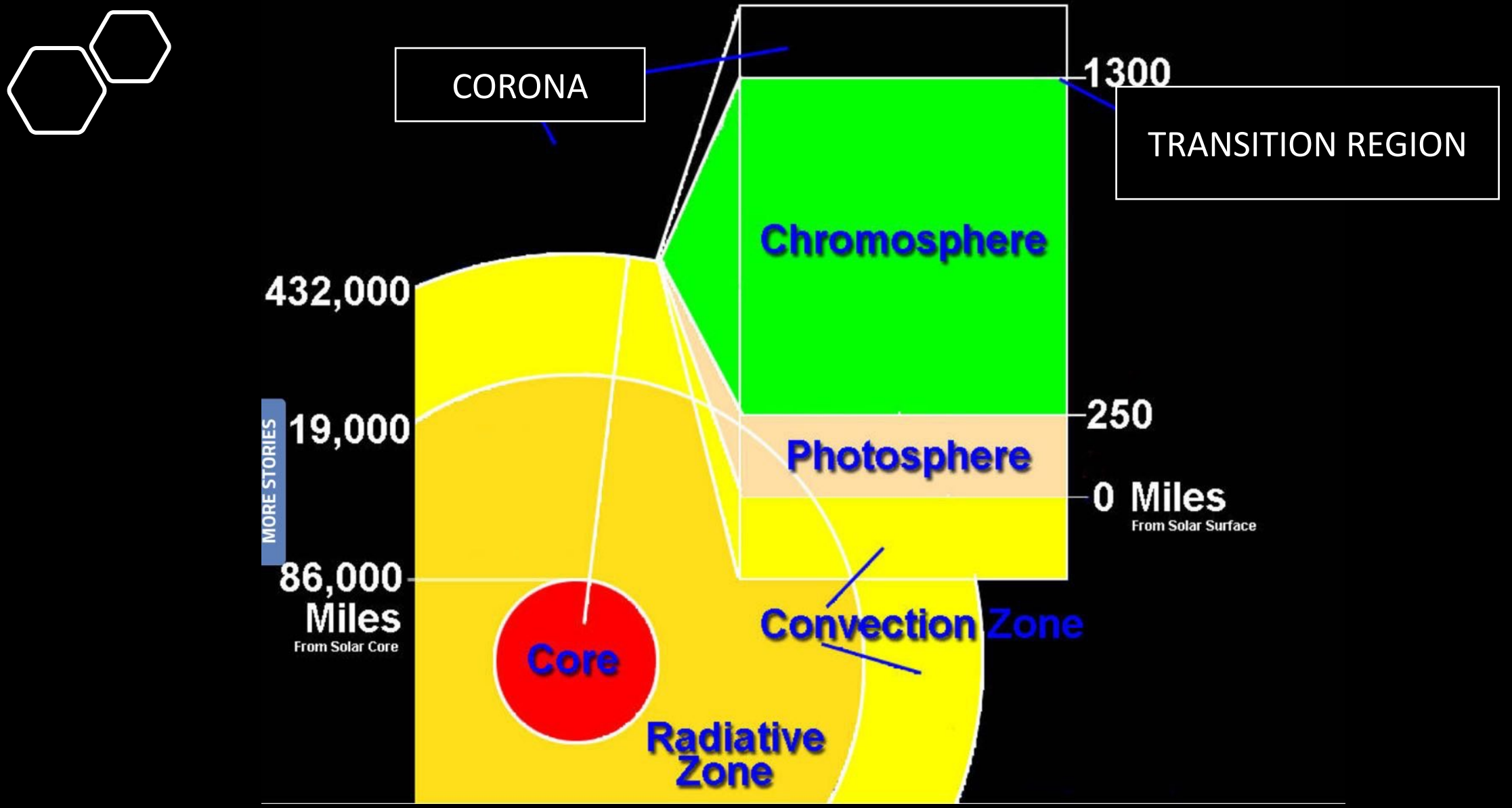
- PSLV will carry the spacecraft to an elliptical orbit around the Earth.
- The velocity of the spacecraft around the Earth will be increased till it is slingshot towards the Sun.
- Which will then be inserted into a halo orbit around the L1 point between the Sun and Earth.

OBJECTIVES OF THE MISSION

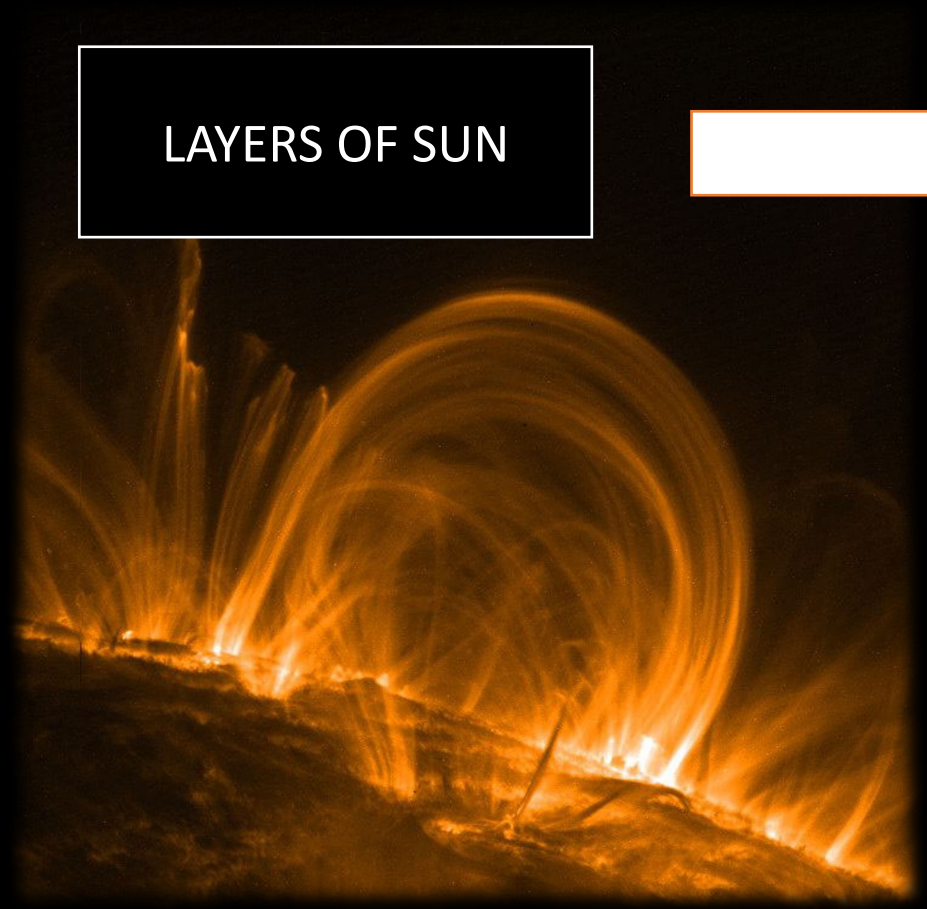
- To get a deeper understanding of the Sun, effects of its radiation, heat flow, flow of particles and magnetic fields.
- The payloads will study the upper atmospheric layers of the Sun called chromosphere and corona. Also coronal mass ejection.
- The mission will also study the magnetic field of the corona and the drivers of space weather.

SUN’S LAYERS

- The corona of the Sun, which is not so bright, is a million degree celsius hot.
- The surface of the Sun, which is called the photosphere, is just 5500 degree celsius.
- There are particles on the Sun which accelerate leading to solar winds.


CORONA
1300
TRANSITION REGION
Chromosphere
432,000
19,000
MORE STORIES
250
Photosphere
0 Miles
From Solar Surface
86,000
Miles
From Solar Core
Core
Convection Zone
Radiative
Zone

LAYERS OF SUN



PHOTOSPHERE

- The PHOTOSPHERE is the deepest layer of the Sun that we can observe directly. It reaches from the surface visible at the center of the solar disk to about 250 miles (400 km) above that.

- The temperature in the photosphere varies between about 6500 K at the bottom and 4000 K at the top (11,000 and 6700 degrees F, 6200 and 3700 degrees Most of the photosphere is covered by granulation.

LAYERS OF SUN

CHROMOSPHERE

- The chromosphere is a layer in the Sun between about 250 miles (400 km) and 1300 miles (2100 km) above the solar surface (the photosphere).

- The temperature in the chromosphere varies between about 4000 K at the bottom (the so-called temperature minimum) and 8000 K at the top (6700 and 14,000 degrees F, 3700 and 7700 degrees C), so in this layer (and higher layers) it actually gets hotter if you go further away from the Sun, unlike in the lower layers, where it gets hotter if you go closer to the center of the Sun.

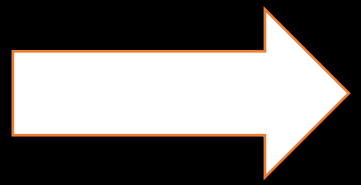
LAYERS OF SUN

CORONA

- The corona is the outermost layer of the Sun, starting at about 1300 miles (2100 km) above the solar surface (the photosphere). The temperature in the corona is 500,000 K (900,000 degrees F, 500,000 degrees C) or more, up to a few million K.

- The corona cannot be seen with the naked eye except during a total solar eclipse, or with the use of a coronagraph. The corona does not have an upper limit.

WHAT ARE LAGRANGE POINTS?



- There are five Lagrange points, from L1 to L5, between any two celestial bodies where the gravitational pull of the celestial objects equals the centripetal force required to the satellite in orbit.
- Therefore such points can be used as parking spots in the space.

ADITYA-L1 SOLAR MISSION

India's first space-based observatory-class mission to unlock the mysteries of the Sun

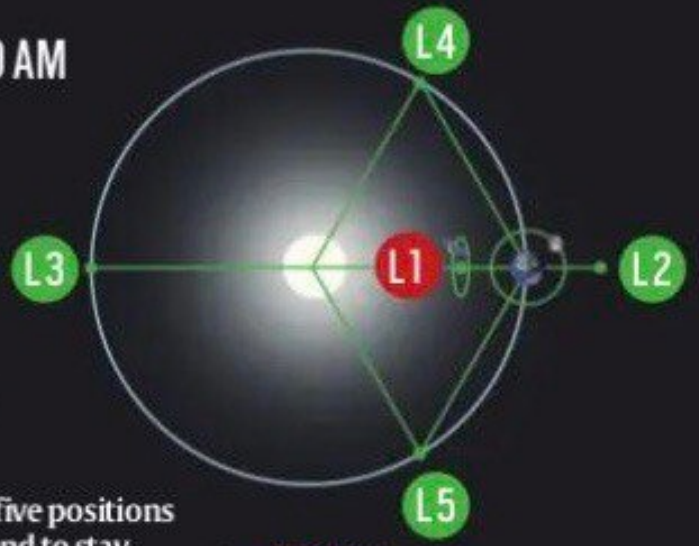
LAUNCH : SEPT 2, 11.50 AM

DISTANCE

1.5-mn km from Earth, about 4 times farther than the Moon. Total travel time from launch to L1: about 4 months

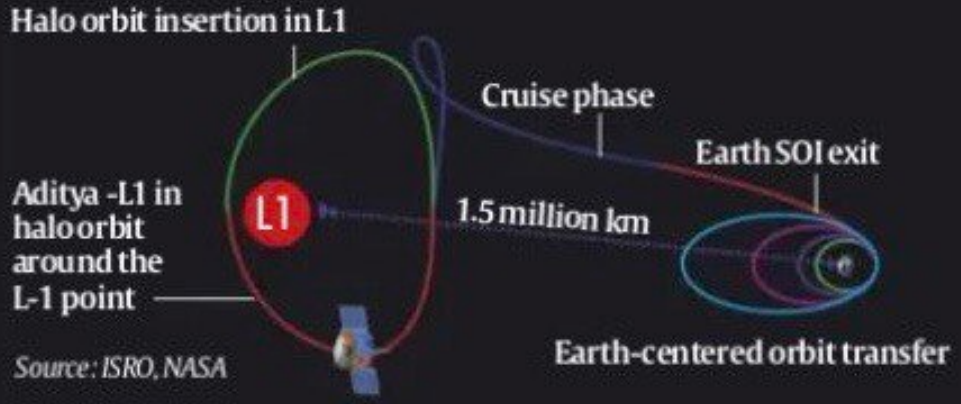
DESTINATION

Lagrange Point (L1), one of five positions where objects, once sent, tend to stay put. At Lagrange Points, gravitational pull of two large masses precisely equals the centripetal force required for a small object to move with them. L1 point affords uninterrupted view of Sun; is currently home to the 'SOHO' satellite



ROUTE

After exiting Earth's gravitational Sphere of Influence (SOI), spacecraft will enter cruise phase; will subsequently be injected into a large halo orbit around L1



Source : ISRO, NASA

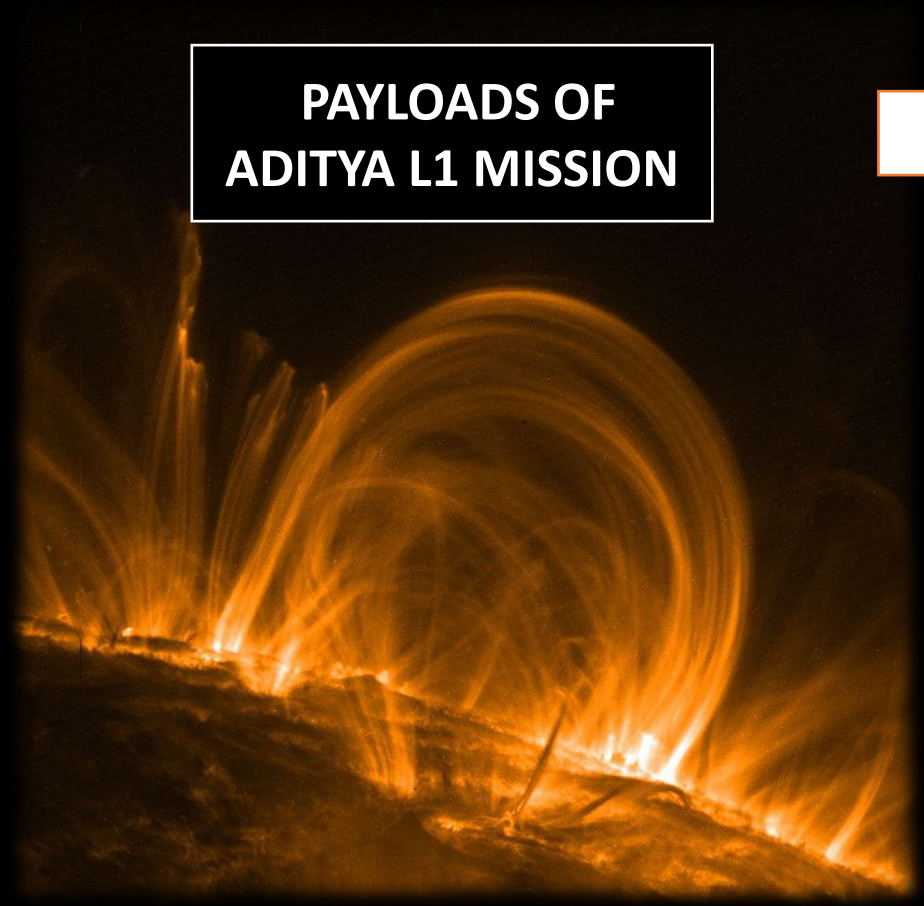
SPACECRAFT

The spacecraft, which will be launched on a PSLV XL rocket, will carry seven payloads to observe the photosphere, chromosphere, and outermost layers of the Sun (corona) using electromagnetic and particle and magnetic field detectors

WHY L1 POINT FOR ADITYA L1 MISSION?

- L1 point is beyond the Moon between the Sun and Earth. Therefore this shall provide an unobstructed view of the Sun even during an eclipse.
- Because L1 is at a distance which is only 1% of the total distance between the Sun and the Earth, it allows the payloads to look directly at the Sun.

PAYLOADS OF ADITYA L1 MISSION



1. Visible Emission Line Coronagraph (VLEC):

- This is to help study the solar corona.
- It can image the solar corona down to 1.05 times the solar radius (closest image to be taken until now).
- It has mechanisms by which the bright visible light is occluded and only light from the corona is detected.

PAYLOADS OF ADITYA L1 MISSION

2. Solar Ultraviolet Imaging Telescope (SUIT):

- It will capture the UV image of the solar photosphere and chromosphere.

3. Solar Low Energy X-ray Spectrometer (SoLEXS) and High Energy L1 Orbiting X-ray Spectrometer (HEL1OS):

- They will study X-ray flares.

4. Aditya Solar wind Particle Experiment (ASPEX) and Plasma Analyzer Package for Aditya (PAPA):

- Solar winds and energetic ions.

IMPORTANCE OF ADITYA L1 MISSION

- Studying the Sun will help us learn about other stars also.
- The Sun also has various explosive phenomena which can damage our satellites and communication systems. Studying the Sun may help provide early warnings.
- Earth’ atmosphere provides a protective layer blocking harmful radiation from the Sun. Thus studying the Sun from the Earth will not give a complete picture.