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Solar Mission & Aditya L-1: A Journey to the Sun

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Abstract:

This article explores global and Indian solar missions, with a focus on India's Aditya-L1. Amid endeavors like NASA's Parker Solar Probe, India's Solar Mission, propelled by ISRO, seeks to decipher the sun's mysteries. Aditya-L1, named after the sun god, targets the solar corona, offering insights into solar phenomena. Anticipated outcomes include enhanced space weather predictions and safeguards for Earth's technologies. International collaboration emerges as a key recommendation for future success. As nations join forces to explore the cosmos, Aditya-L1 exemplifies India's stride in space exploration, igniting optimism for scientific revelations and global cooperation in solar study.

Keywords: Solar Mission, Aditya-L1, Indian Space Research Organization (ISRO), Space weather, Solar flares, Magnetic fields, International collaboration, Space technology, Public engagement, Lagrangian point L1

1. Introduction:

In the vast expanse of space, our Sun stands as a colossal powerhouse, and understanding its mysteries is a challenge that intrigues scientists worldwide. The Solar Mission and Aditya-L1, led by the Indian Space Association, mark significant milestones in unraveling the secrets of our celestial neighbor.

2. Global Mission about Solar Mission:

Various nations globally are engaged in solar missions to unravel the mysteries of our Sun. NASA's Parker Solar Probe is actively studying the Sun's outer atmosphere, while the European Space Agency's Solar Orbiter aims to explore the Sun's polar regions. Additionally, the Solar and Heliospheric Observatory (SOHO), a collaboration between NASA and the European Space Agency, continues to provide valuable solar data. The global scientific community's concerted efforts in solar research, through these and other missions, seek to enhance our understanding of solar dynamics, space weather, and their potential impacts on Earth's technological infrastructure, fostering collaborative exploration and knowledge-sharing in the realm of helio-physics.

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Figure- 1: Poster on Launch of PSLV-C57/Aditya-L1 Mission from Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota, ISRO.com¹



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Figure- 2: Image depicting the Halo Orbit of Aditya L-1²

3. Indian Mission about Solar Mission:

India, too, has made remarkable strides in solar exploration through its dedicated Solar Mission. India's solar exploration endeavors include the Aditya-L1 mission, a pioneering effort by the Indian Space Research Organisation (ISRO). Launched to study the Sun, Aditya-L1 aims to unlock secrets of the solar corona, providing vital insights into space weather dynamics. Additionally, India envisions further solar missions to deepen its understanding of the Sun's influence on Earth and advance solar science. These missions are integral to developing technologies resilient to space weather impacts, reinforcing India's position in space research and fostering global collaboration for a deeper comprehension of our solar system's central star.

4. Details about Aditya-L 1:

Aditya-L1 is an important space mission by India, managed by the Indian Space Research Organisation (ISRO. The main goal of this mission is to learn more about the Sun and its effects on space weather. The spacecraft, set to launch soon, will focus on studying the outer layer of the Sun called the corona. Aditya-L1 carries special tools, including a solar coronagraph, to help scientists observe and understand solar activities. By studying the Sun, Aditya-L1 aims to improve our understanding of space weather phenomena. This includes events like solar flares and their impact on Earth. The mission's findings could be crucial for technologies like communication and navigation systems, as space weather can affect these systems.

¹ Fig 1: Poster Launched by ISRO <u>https://www.youtube.com/watch?v=_IcgGYZTXQw</u> ;ISRO Article source: <u>https://www.isro.gov.in/</u> ;ISRO.com

² Fig 2: Aditya L1 highlights: 'Looking forward to lot of scientific outcomes,' says ISRO chairman on maiden solar mission, Hindustan Times

March, 2024

In simple terms, Aditya-L1 is like a space detective sent by India to investigate the Sun's behavior. By doing so, scientists hope to unlock important information that can help us better prepare for and understand space-related events that might influence our daily lives on Earth.







Figure-4: Aditya L-1 launch⁴

5. Output Revealed from the Solar Mission & Aditya-L 1:

The Aditya-L1 solar mission, led by the Indian Space Research Organisation (ISRO), has yielded valuable insights into the Sun's behavior. By studying the Sun's outer layer, the corona, the mission has provided crucial data on solar activities and their impact on space weather. The spacecraft's scientific instruments, including a solar coronagraph, have allowed scientists to observe and analyze solar phenomena such as flares and eruptions.

The information gathered from Aditya-L1 is significant for enhancing our understanding of space weather dynamics, which can affect satellite communication, navigation systems, and power grids on Earth. The mission's output contributes to global efforts in space science, aiding in the development of technologies that can mitigate the potential adverse effects of space weather events. Aditya-L1 marks a milestone in India's space exploration endeavors, showcasing the nation's commitment to advancing scientific knowledge and technological capabilities in the field of solar research.

6. Future Planning for the Space Mission of India and other Countries:

India, along with other countries, is actively planning future space missions to explore new frontiers. ISRO envisions missions for lunar exploration, interplanetary exploration, and satellite

³ Fig-3: Aditya-L1 Mission: 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; Mint. ⁴ Fig-4: Aditya L1 spacecraft launched successfully; first EarthBound firing scheduled for tomorrow, ThePrint

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launches. Key focuses include the Gaganyaan human spaceflight program, Chandrayaan-3 lunar exploration, and the Aditya-L1 follow-up mission. Globally, countries like the United States, China, and Russia are pursuing ambitious space plans, including Moon and Mars missions. Collaborative efforts, such as the International Space Station (ISS), and advancements in satellite technology for Earth observation and communication, reflect the shared commitment to pushing the boundaries of space exploration for scientific discovery and technological innovation.



Figure- 5: Animated representation of Aditya L-1 in Sun's Halo Orbit⁵



Figure- 6: Aditya L-1 Mission Trajectory⁶

7. Suggestions:

As we delve into the vastness of space, it is crucial for nations to share data, research findings, and technological advancements. Collaborative efforts can accelerate progress and ensure a comprehensive understanding of solar phenomena. Additionally, increased public awareness and education initiatives can generate widespread interest and support for space exploration.

8. Conclusion:

The Solar Mission, with Aditya-L1 at its forefront, marks a significant stride for India in the realm of space exploration. By unraveling the sun's secrets, these endeavors promise to revolutionize our understanding of the universe and fortify our preparedness for space weather impacts on Earth. As the global community collaborates to explore the cosmos, the sky is not the limit but a gateway to endless possibilities, fostering a collective journey toward scientific excellence.

⁵ Fig 7: Halo Orbit <u>https://english.jagran.com/india/india-sun-mission-aditya-l1-enters-final-halo-orbit-what-it-will-do-next-full-details-10125422</u>, Jagran Josh

⁶ Fig 8: India's solar mission Aditya-L1 nears destination, to reach Lagrange Point 1 in first week of January, Bt Business Today.

https://www.businesstoday.in/technology/news/story/indias-solar-mission-aditya-l1-nears-destination-to-reach-lagrange-point-1-in-first-week-of-january-410180-2023-12-20

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