Asymmetric Expansion of Solar Eruption

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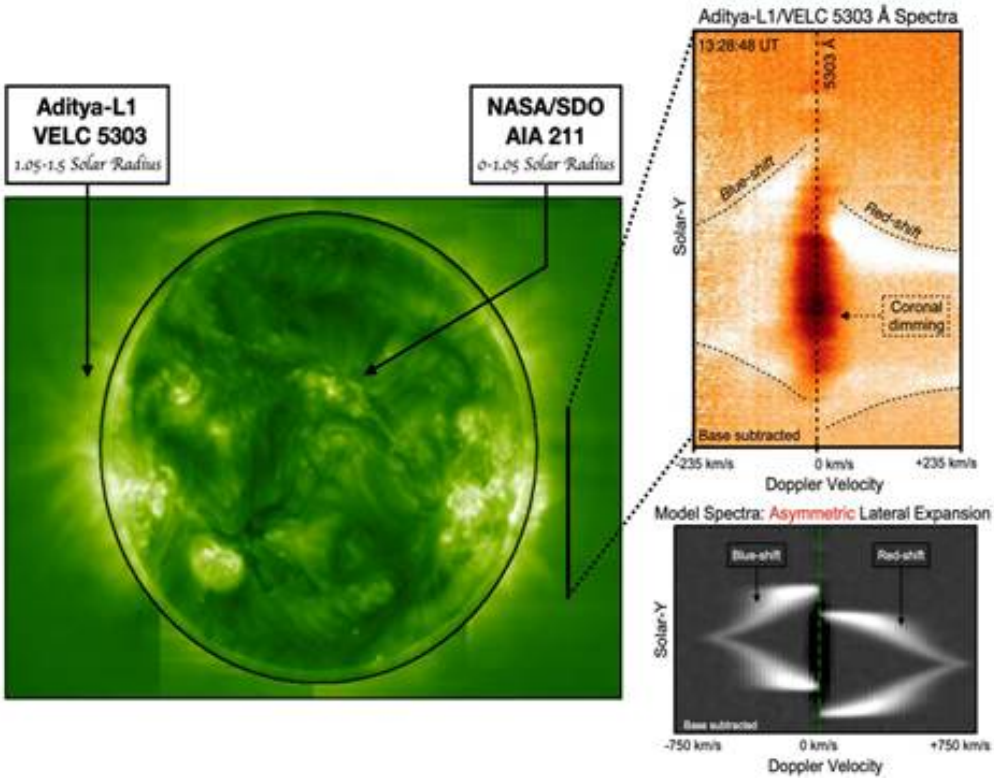
Why in news?

VELC on board Aditya-L1 reveals asymmetric expansion of a solar eruption that could impact space weather.

- **Asymmetric expansion of a solar eruption** – It refers to the uneven, lopsided growth of a massive cloud of solar plasma and magnetic fields—known as a Coronal Mass Ejection (CME)—as it blasts away from the Sun.
- Instead of ballooning outward uniformly like a smooth, symmetrical sphere, the eruption stretches more in some directions than others and often tilts at an angle.
- **Aditya-L1** – India's first space-based solar observatory, launched in September 2023, is now operational at the Sun–Earth L1 point, providing continuous observations of the Sun.
- It carries 7 payloads, with the Visible Emission Line Coronagraph (VELC) serving as its primary payload.
- **VELC** – Designed to observe the solar corona, VELC studies the early stages of CMEs through spectroscopy in the 530.3-nanometre green emission line, produced by highly ionised iron atoms in the corona.
- This enables scientists to study the hot coronal plasma and measure its movement through Doppler shifts.
- Designed and developed by the Indian Institute of Astrophysics at its MGK Menon Laboratory for Space Sciences on the CREST campus in Hosakote, with substantial support from ISRO.

Key findings

- The scientists from the Indian Institute of Astrophysics (IIA), an autonomous institution of the Department of Science and Technology (DST), were able to reconstruct the full 3-D geometry and dynamics of solar eruptions.
- **Instruments & Data used** – The findings combined Aditya-L1's Visible Emission Line Coronagraph (VELC), NASA's Solar Dynamics Observatory (SDO), and 3D modelling.
- **Eruption** – The CME that occurred on 5 August 2024, near the western limb of the Sun, found that CME did not expand outward from the Sun as a symmetrical bubble. Instead, it exhibited non-uniform expansion, developing an asymmetric shape.
- VELC's spectroscopic observations detected distinct blueward and redward shifts in emission, indicating plasma moving towards and away from the observer, respectively.



- **Implications** – Scientists say the asymmetric expansion of CMEs could influence their speed and interaction with the solar wind as they travel through the heliosphere.
- These factors may affect the timing of their arrival at Earth and the intensity of potential space-weather disturbances.

Reference

DD News | Aditya-L1 Uncovers Asymmetric Expansion of Solar Eruption

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