



# Coronal Mass Ejections

## Why in News?

Researchers have been closely monitoring **the ongoing changes in the energy state of the solar eruption's core** that occurred on July 20, 2017, and have made an intriguing discovery.

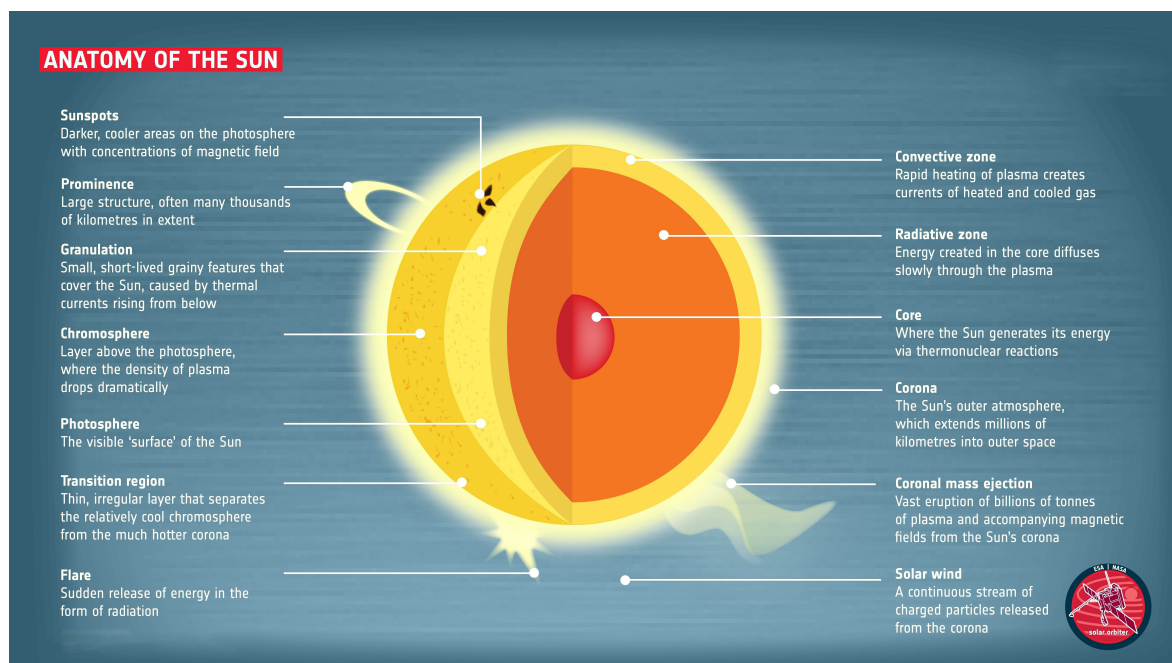
- Despite the **eruption expelling highly magnetized plasma from the solar corona** into space, the **core has maintained a consistently stable temperature**. This finding holds promise for enhancing our comprehension of the potential **impact of such eruptions on Earth's communication systems**.

## What are the Findings of the Study?

- The Coronal Mass Ejections (CMEs) core **maintained a constant temperature as it propagated from 1.05 to 1.35 R sun**, despite the expected adiabatic cooling due to the expansion of the core.
  - The expression "1.05 to 1.35 R<sub>sun</sub>" **refers to a range of values that represent the size or radius of the Sun**. The object being described has a radius ranging from 1.05 times the radius of the Sun (R<sub>sun</sub>) to 1.35 times the radius of the Sun.
- The expansion of CME core **behaves more like an isothermal than an adiabatic process**.
  - An **isothermal process** is a type of thermodynamic process **in which the temperature of a system remains constant**.
  - An **adiabatic process** happens when there is **no heat transfer between the system and its surroundings**.

## What are Coronal Mass Ejections?

- **Coronal Mass Ejections (CMEs)** are large-scale **eruptions** of charged particles (**plasma**) and **magnetic fields from the solar atmosphere into space**. They can disrupt a range of ground- and space-based technologies and satellites on Earth.
  - The evolution of thermodynamic properties of CMEs, such as temperature and density, is crucial to understanding their impact on communication systems on Earth.
- There is a **wide range of plasma temperatures within CMEs**, from cold chromospheric material (around 10<sup>4</sup> K) to hot plasma (around 10<sup>7</sup> K).
- When CMEs **propagate**, **several processes can exchange energy (electrical, kinetic, potential, thermal, and so on.)**, thereby heating or cooling the plasma. Understanding CMEs will help our ability to monitor space weather.



## What is India's Solar Mission?

- The **Visible Emission Line Coronagraph (VELC)** onboard [Aditya-L1](#), India's first solar mission, will perform both spectroscopy and imaging of CMEs in the inner corona and provide new insights into the evolution of CME thermodynamic properties in the inner corona.

## UPSC Previous Year Question (PYQ)

### Prelims

**Q. In order of their distance from the Sun, which of the following planets lie between Mars and Uranus? (2008)**

- (a) Earth and Jupiter
- (b) Jupiter and Saturn
- (c) Saturn and Earth
- (d) Saturn and Neptune

**Ans: (b)**

**Q. The increasing amount of carbon dioxide in the air is slowly raising the temperature of the atmosphere, because it absorbs (2012)**

- (a) the water vapour of the air and retains its heat
- (b) the ultraviolet part of the solar radiation
- (c) all the solar radiations
- (d) the infrared part of the solar radiation

**Ans: (d)**

**Q. The terms 'Event Horizon', 'Singularity', 'String Theory' and 'Standard Model' are sometimes seen in the news in the context of (2017)**

- (a) Observation and understanding of the Universe
- (b) Study of the solar and the lunar eclipses
- (c) Placing satellites in the orbit of the Earth
- (d) Origin and evolution of living organisms on the Earth

**Ans: (a)**

**Source: PIB**

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