

Solar Coronal Holes

Source: PIB

The study has revealed that Indian astronomers have accurately estimated the thermal and magnetic field structures of solar coronal holes (SCH).

What are Solar Coronal Holes?

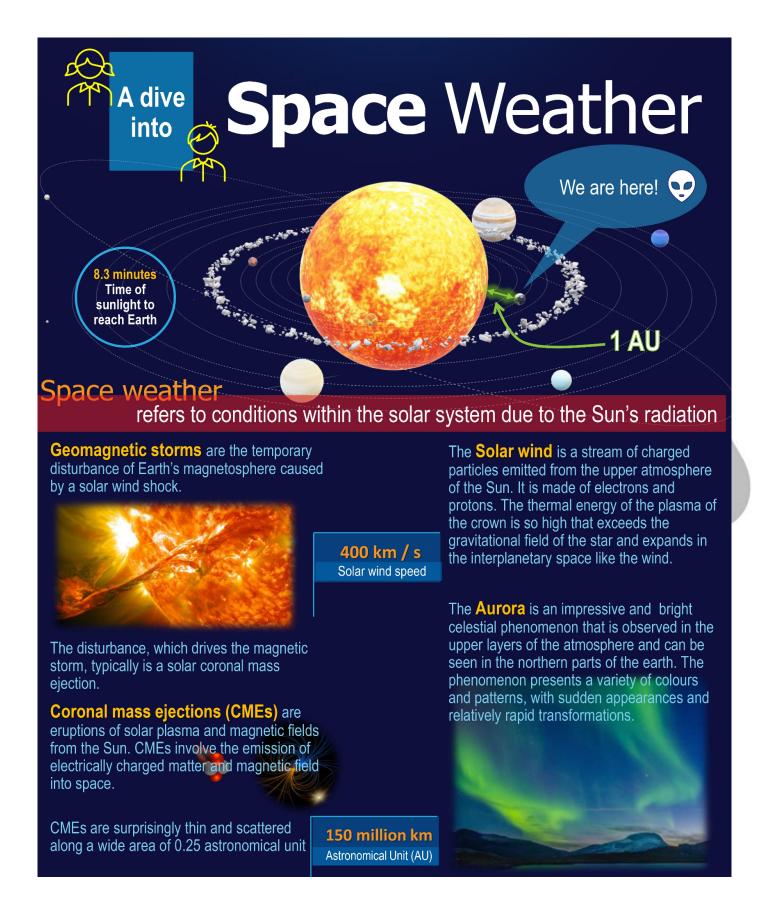
- About: Coronal Holes are large, dark regions on the Sun that are cooler and less dense than the surrounding plasma. It was first discovered in the 1970s by X-ray satellites.
- Occurrence:
 - They occur in areas where the **Sun's magnetic field** is open to interplanetary **space**, allowing **high-speed solar wind** (**geomagnetic storm**) to escape.
 - Open magnetic field lines are **magnetic field lines** that **do not form closed loops** but extend outward into space without returning to their source.
 - Coronal holes are most prevalent during the <u>declining phase of a solar cycle</u> and are typically found near the Sun's poles.
- Properties of Coronal Holes:
 - **Uniform Temperature:** Coronal holes maintain a consistent temperature across latitudes, indicating a deep origin within the Sun.
 - Magnetic Field Variation: Magnetic field strength increases from the solar equator to the poles, likely influenced by Alfvén wave disturbances.
 - Alfvén wave disturbances are low-frequency oscillations in the magnetic field and ions of a plasma that can cause fluctuations in the solar wind and geospace.
- Impacts of SCH:
 - Impact on Space Weather: The high-speed solar wind from coronal holes interacts with Earth's magnetic field, causing geomagnetic storms that can disrupt satellites, GPS, and communication networks.
 - Effect on Indian Monsoon: The study suggests that, along with sunspots, the radiative effects of coronal holes influence Indian monsoon rainfall variability.
 - lonospheric Disturbances: Coronal hole activity affects Earth's ionosphere, impacting radio wave propagation and telecommunication systems.

Sunspots

- <u>Sunspots</u> are dark areas on the sun's surface that are caused by strong magnetic fields. They are cooler than the surrounding areas of the sun, making them appear darker on the surface of the Sun (photosphere).
- Coronal holes and sunspots differ in location, magnetic field, and visibility.

	Coronal hole	Sunspot
Location	In the sun's upper atmosphere, the corona	In the sun's lower atmosphere, the photosphere
Magnetic field	Open magnetic lines that allow solar wind to flow freely	Extremely strong magnetic fields with twisted magnetic lines
Visibility	Only visible in UV or X-ray light	Visible in visible light





Read More: What is a Geomagnetic Storm?

Q. If a major solar storm (solar flare) reaches the Earth, which of the following are the possible effects on the Earth? (2022)

- 1. GPS and navigation systems could fail.
- 2. Tsunamis could occur at equatorial regions.
- 3. Power grids could be damaged.
- 4. Intense auroras could occur over much of the Earth.
- 5. Forest fires could take place over much of the planet.
- 6. Orbits of the satellites could be disturbed.
- 7. Shortwave radio communication of the aircraft flying over polar regions could be interrupted.

Select the correct answer using the code given below:

- (a) 1, 2, 4 and 5 only
- (b) 2, 3, 5, 6 and 7 only
- (c) 1, 3, 4, 6 and 7 only
- (d) 1, 2, 3, 4, 5, 6 and 7

Ans: (c)

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