



Auroras

Why in News?

A significant [geomagnetic storm](#) is anticipated, triggered by **strong solar storm**. This occurrence has the potential to "**supercharge**" auroras, creating a **spectacular visual display in the night sky**.

What are Auroras?

▪ About:

- Auroras are **luminous phenomena that occur near the North (Aurora Borealis) and South Poles (Aurora Australis)**.
- They are caused by the **interaction of charged particles from the Sun with the Earth's magnetic field and atmosphere**.



▪ Composition and Colors:

- Auroras consist of **gases and particles, including oxygen and nitrogen**.
- The collisions of these particles with the atmosphere **release energy in the form of light**.
- The colors observed in auroras depend on the **type of gas and altitude of the collisions**.

▪ Geomagnetic Storms and Auroras:

- Geomagnetic storms, triggered by **solar events like [coronal mass ejections \(CMEs\)](#) and solar flares, enhance auroral activity**.
 - CMEs are **eruptions of plasma and magnetic fields from the Sun**, while **solar flares are bursts of energy**.
 - CMEs often occur alongside solar flares, which are explosions on the Sun's surface,

but they are **also known to occur independently.**

- **Solar Storms and Aurora Intensity:**
 - Strong solar storms result in **increased solar activity**, leading to **more pronounced auroral displays.**
 - The number of charged particles reaching the Earth's atmosphere during these storms intensifies the auroras.
 - The **strength of the solar storm** and the **alignment of the Earth's magnetic field affect the visibility and vibrancy** of the auroras.
- **Cultural and Scientific Significance:**
 - Auroras hold cultural and spiritual significance in various indigenous communities around the world.
 - Scientific research on auroras helps us understand the **Earth's magnetosphere, solar-terrestrial interactions, and space weather.**

What is a Geomagnetic Storm?

- **About:**
 - A geomagnetic storm refers to the **disruptions to the Earth's magnetic field caused by solar emissions.**
- **Cause:**
 - The largest storms that result from these conditions are associated with solar coronal mass ejections (CMEs). When a **CME or a high-speed solar stream** reaches our planet, it slams into the magnetosphere.
 - The Earth's magnetosphere is created by its magnetic fields and it usually protects us from the particles emitted by the Sun.
 - When a CME or a high-speed stream arrives at Earth, it **peels open the planet's magnetosphere**, kind of like an onion. This allows **energetic solar wind particles to stream down and hit our atmosphere over the poles.**
- **Conditions:** The solar wind conditions that are effective for creating geomagnetic storms are:
 - **Sustained (for several to many hours) periods of high-speed solar wind**
 - A **southward directed solar wind magnetic field** (opposite the direction of Earth's field) at the dayside of the magnetosphere.
- **Impact:**
 - Solar weather events like this can **supercharge auroras**, sometimes making them visible in places where they wouldn't have been otherwise.
 - They can also **disrupt navigation systems** and **create harmful geomagnetic induced currents (GICs)** in the power grid and pipelines.

UPSC Civil Services Examination, Previous Year Question (PYQ)

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

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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