Aurorae in Ladakh

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Why in News?

Recently, **auroras** were sighted in **lower-latitude regions** (below 66.5 degrees north and south latitudes) like **India (Hanle and Merak in Ladakh), Mexico and Germany**.

- Their occurrence in lower-latitude regions is an indication of **heightened solar activity.**

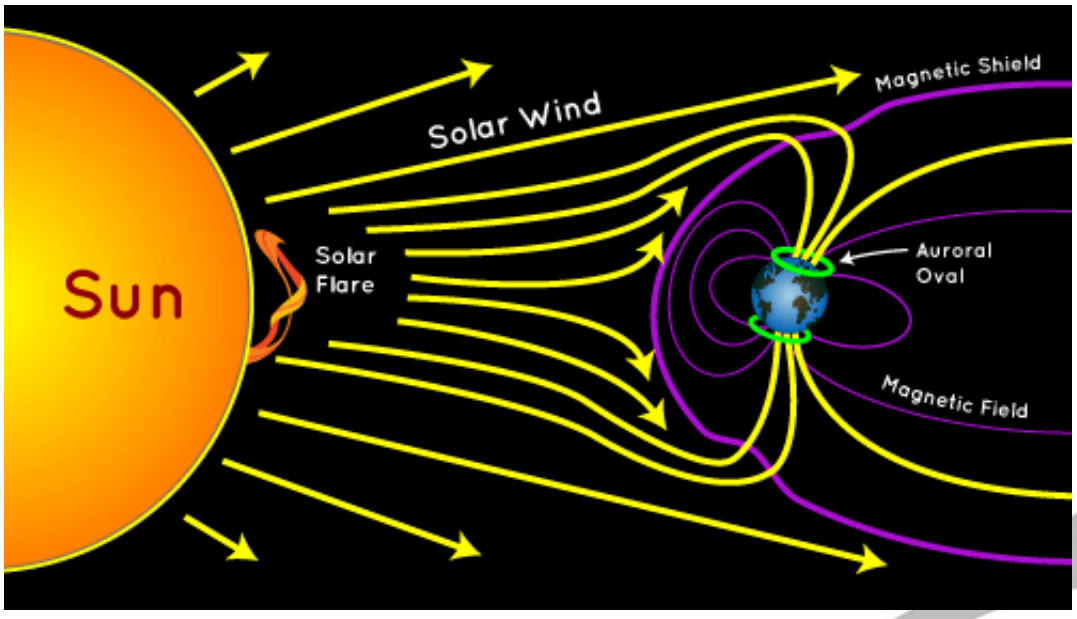
What are the Key Highlights About Aurora Sightings?

- **Aurora and Peak Solar Cycle:** Auroras occur when **coronal mass ejections (CMEs)** interact with **Earth's Magnetosphere**.
  - **Coronal mass ejections (CMEs)** are part of the **solar activity cycle,** which lasts around **11 years.**
  - The current solar cycle called **Solar Cycle 25** is at its peak in **2024.**
- **Lower Latitude Aurora:** A **severe solar storm**, initially classified as a **level 4** on a scale from 1 to 5, is the reason for aurora sightings in lower-latitude regions.
  - It typically appears in northern regions like **Canada, Norway, Sweden, Finland, Alaska, Russia, Iceland, and Greenland.**
    - **Severe** solar storms can trigger auroras and accelerate **satellite decay,** while **extreme** storms may destroy satellites, **disrupt power grids,** and cause **widespread communication blackouts.**

What are Key Facts About Auroras?

- **About Aurora:** An aurora is a mesmerising **natural light display** visible in the **night sky,** often characterised by shifting colours such as **blue, red, yellow, green, and orange**.
  - The more common **green-yellow auroras** result from ions striking oxygen atoms at **lower altitudes.**
  - **Reddish and bluish lights**, seen in the lower edges of auroras, are caused by ions interacting with **nitrogen atoms**.
  - Collisions with **hydrogen and helium atoms** can produce **blue and purple auroras,** but these colours are **rarely visible** to the naked eye.
- **Geographical Occurrence:** Auroras are most commonly seen near the **Arctic and Antarctic Circles**, approximately **66.5 degrees north and south of the Equator**.
  - The **northern** aurora is called the **aurora borealis (northern lights)**, while the **southern** counterpart is known as **aurora australis (southern lights).**
- **Cause of Auroras:** Auroras are caused when **charged particles** from solar storms interact with the **Earth's magnetosphere**, which acts as a **shield** against harmful **solar and cosmic rays.**
  - Solar storms occur when the **Sun's magnetic field intensifies and weakens**, allowing charged particles to **penetrate** the Earth's magnetic field.
- **Role of Solar Wind and Earth's Magnetosphere:** Auroras form when **charged ions** from the solar wind collide with **oxygen and nitrogen atoms** in the Earth's ionosphere, usually at altitudes between **97 and 1,000 kilometers.**
  - The Earth's magnetosphere deflects most of the solar wind, but some ions get trapped near

the geomagnetic poles, creating these stunning light displays.



- **Scientific Study of Auroras: NASA's IMAGE satellite**, which operated until 2005, was designed specifically to **study auroras.**
  - Using **ultraviolet and radio waves**, IMAGE gathered important data on how auroras form and behave.
- **Aurora on Other Planets:** Planets with an **atmosphere and magnetic field** likely experience auroras.
  - E.g., Stunning auroras have been observed on **Jupiter and Saturn**.

What are Key Facts About Hanle Observatory?

- **Location**: It is located on **Mt. Saraswati** in the **Nilamkhul Plain, Hanle Valley**, Ladakh. at a height of approximately 4,500 metres above sea level.
  - It is also known as the **Indian Astronomical Observatory** managed by **Indian Institute of Astrophysics.**
- **Recognition:** It is recognised for its exceptionally **dark and cloudless skies** ideal for stargazing and **astronomical observations.**
- **Observational Capabilities**: It is home to a 2-metre optical infrared telescope for space observation.
- **Dark Sky Reserve**: Hanle is designated as a **Dark Sky Reserve** by the **International Dark-Sky Association (IDA)** to protect the quality of night skies by minimising light pollution.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims

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)