Coronal Mass Ejections

Why in News

Indian Scientists, along with international collaborators, have **measured the magnetic field of an eruption from the Sun's atmosphere** (solar corona), offering a rare peek to the interior of the Sun.

- **Coronal Mass Ejection (CME)** is **one of the biggest eruptions from the Sun's surface** that can contain a billion tons of matter accelerated to several million miles per hour into space.

Key Points

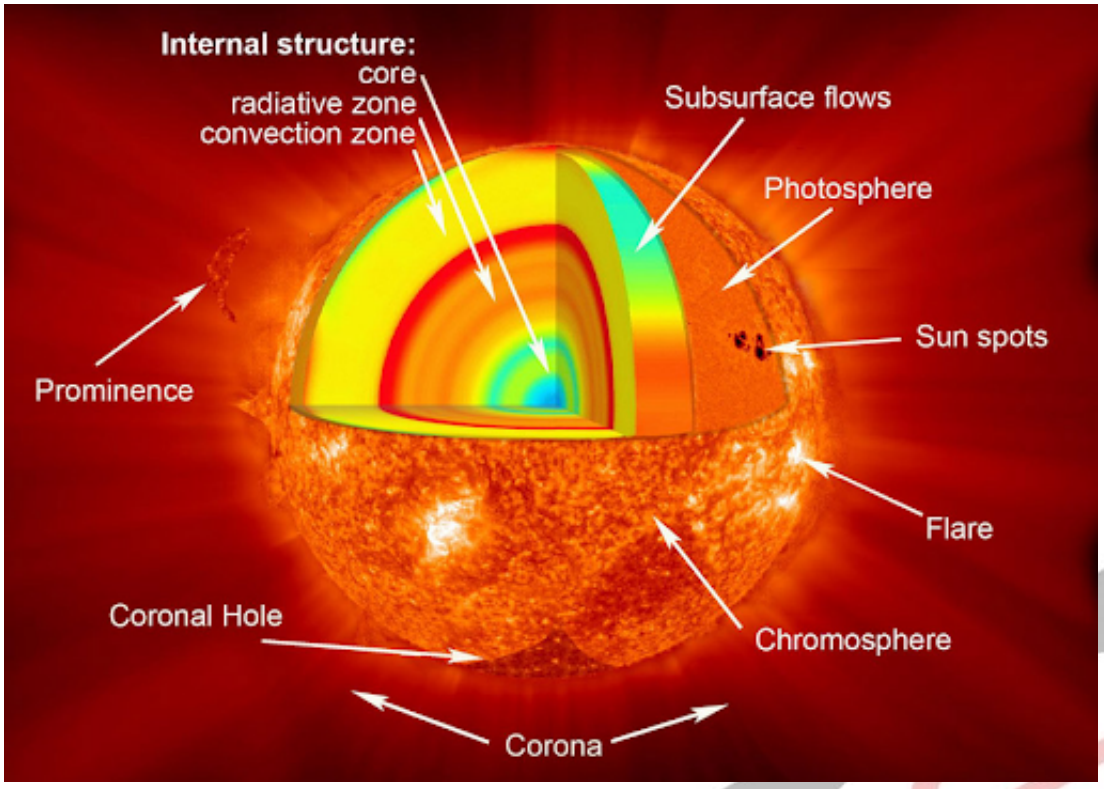
- **About the Research:**
    - Scientists from the **Indian Institute of Astrophysics (IIA) studied the weak thermal radio emission associated with the erupted plasma for the first time,** measuring the magnetic field and other physical conditions of the eruption.
        - **IIA** is an autonomous institute of the **Department of Science & Technology** (DST), at Gauribidanur, Karnataka.
    - The team **studied the plasma from the Coronal Mass Ejection (CME)** that happened on 1st May, 2016.
        - Plasma is also known as the **fourth state of matter.** At high temperatures, electrons are ripped from atom’s nuclei and become a plasma or an ionised state of matter.
    - The emissions were detected with the help of radio telescopes of the IIA, along with some space-based telescopes that **observed the Sun in extreme ultraviolet and white light.**
    - They were also **able to measure the polarisation of this emission,** which is indicative of the direction in which the electric and magnetic components of the waves oscillate.
- **About the Coronal Mass Ejections:**
    - The Sun is an extremely active object, **spewing out vast quantities of gas and plasma** in many violent events.
        - A class of such eruptions are **Coronal Mass Ejections (CMEs).**
        - CMEs are the **most powerful explosions happening in the solar system.**
    - The underlying cause of CMEs is not well understood. Astronomers agree, however, that the **sun’s magnetic field plays a major role.**
    - Though CMEs can occur anywhere on the Sun, it is primarily those which originate from regions near the centre of the visible solar surface (**called the photosphere**) that are important for study, since they may propagate directly towards the Earth.
        - This field of research helps to understand **Space Weather.**
    - When a really strong CME blows past the Earth, it can **damage the electronics in satellites** and **disrupt radio communication** networks on Earth.
    - When the plasma cloud hits our planet, a **geomagnetic storm** follows.

        - A geomagnetic storm is a **major disturbance of** Earth's magnetosphere (space controlled by earth's magnetic field) that occurs when there is a very efficient exchange of energy from the solar wind into the space environment surrounding Earth.
    - They can trigger intense light in the sky on Earth, called **auroras.**

        - Some of the energy and small particles travel down the magnetic field lines at the north and south poles into Earth's atmosphere.
        - There, the particles interact with gases in the atmosphere resulting in beautiful displays of light in the sky.
        - The aurora in Earth's northern atmosphere is called an **aurora borealis** or northern lights. It's southern counterpart is called an **aurora australis** or the southern lights.

Anatomy of the Sun

- **The Sun's Core -** Energy is generated via thermonuclear reactions creating extreme temperatures deep within the Sun's core.
- **The Radiative Zone** - Energy moves slowly outward, taking more than 1,70,000 years to radiate through this layer of the Sun.
- **The Convection Zone** - Energy continues to move toward the surface through convection currents of the heated and cooled gas.
- **The Chromosphere** - This relatively thin layer of the Sun is sculpted by magnetic field lines that restrain the electrically charged solar plasma. Occasionally larger plasma features, called prominences, form and extend far into the very tenuous and hot corona, sometimes ejecting material away from the Sun.
- **The Corona -** The ionized elements within the corona (or solar atmosphere) glow in the x-ray and extreme ultraviolet wavelengths. Space Instruments can image the Sun's corona at these higher energies since the photosphere (lowest layer of the solar atmosphere) is quite dim in these wavelengths.
- **Coronal Streamers -** The outward flowing plasma of the corona is shaped by magnetic field lines into tapered forms called coronal streamers, which extend millions of miles into space.
- **Sunspots** are areas that appear dark on the surface of the Sun. They appear dark because they are cooler than other parts of the Sun's surface.



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