# Clue to mystery of solar flares & CMEs in regions on Sun

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**In news**– Recently, astronomers got a clue to the mystery of solar flares & **Coronal Mass Ejections(**CMEs) in regions on the Sun with disturbed magnetic fields.

**Key findings-**

- Astronomers exploring **regions on the Sun with disturbed magnetic fields or active regions that sometimes exhibit solar flares without accompanying CMEs** have confirmed that **changing structure of the magnetic field on the Sun's surface determined whether a flare or a CME was emitted**.
- This understanding will be **useful in improving predictions of solar weather,** which can affect electrical, and communication systems on Earth and satellite systems in space.
- **The scientists from the Indian Institute of Astrophysics(IIA), Bengaluru, an autonomous institute of the Department of Science & Technology,** Government of India, **first spotted a peculiar evolution of helicity injection** in the **Active Region** called AR 12257 without CMEs.
- The **scientists studied this astronomical event based on the magnetic and coronal images of the Sun,** taken every 12 minutes by **NASA's Solar Dynamics Observatory in space**.
- It found that the **AR injected positive helicity in the first 2.5 days followed by negative helicity** after that.
- **The study showed** that active regions where the sign of

the helicity (or twist) reverses with time cannot produce coronal mass ejection.

- According to the IIA team, studies of how **helicity is injected seem to be key to predict the eruptive potential of an active region,** and these results are expected to shed light on magnetic field production in stars and planets as well.

**Sun's magnetic field and Solar flare-**

- The Sun has a complex **magnetic field** near its surface that is **connected to its hot plasma and changes its configuration all the time** as the plasma itself moves around in this field.
- **This magnetic field can erupt out of some regions (called Active Regions) on the Sun's surface** in loops, become twisted, realign its geometry, and release tremendous amounts of energy in the process, which was stored as magnetic energy till then.
- **The light (in many wavebands) emitted in this process is called a solar flare.**
- On the other hand, a CME is when a huge amount of hot gas, with its embedded magnetic field, is ejected at high velocities into the solar corona.
- It is known that some Active Regions produce flares, some produce CMEs, and some produce both.
- What determines this difference remains a puzzle though earlier studies indicated that the **mystery lies in the magnetic field in this region.**
- The **underlying magnetic configuration that stores energy is typically seen having twisted magnetic fields,** which are quantified by a parameter known as magnetic helicity.
- The corona of the active region (AR) is being pumped with such twists or magnetic helicity.
- When helicity reaches beyond a threshold level, CME is the only way to remove the excess helicity.

- However, finding the threshold level of the coronal helicity budget is still a formidable problem for the prediction of a CME eruption in due course of the AR evolution.