Solar Jets

Why in News?

Recently, Scientists at **Indian Institute of Astrophysics (IIA)** have unravelled the science behind the **jets of plasma** on the **Sun’s chromosphere.**

- The Sun's chromosphere is the **atmospheric layer just above the Sun's visible surface.**
- IIA is an **autonomous institute of the Department of Science and Technology,** Government of India.

What are Solar Jets or Spicules?

- Solar plasma jets, or spicules, are powerful plasma streams constantly ejecting from the Sun’s chromosphere (an atmospheric layer above the Sun’s visible surface).
    - Solar jets, or spicules, appear as **thin grass-like plasma structures** that constantly shoot up from the surface and are then **brought down by gravity.**
- These jets rise and fall back under the influence of the Sun’s gravity, which is **20 to 30 times greater than Earth.**
- Some jets are so energetic that they propel into the solar corona and beyond.

- The amount of energy and momentum that these spicules can carry is of fundamental **interest in solar and plasma astrophysics.**
- The four key ingredients favouring solar jets are the **plasma’s fluid nature, gravity, strong quasi periodic triggers to eject the plasma** and most importantly, **the Sun’s powerful magnetic field** giving it specific direction for ejection.
- The processes by which plasma is supplied to the solar wind, and the solar atmosphere is heated to a **million degrees Celsius**, still remain a puzzle.

Structure of Sun

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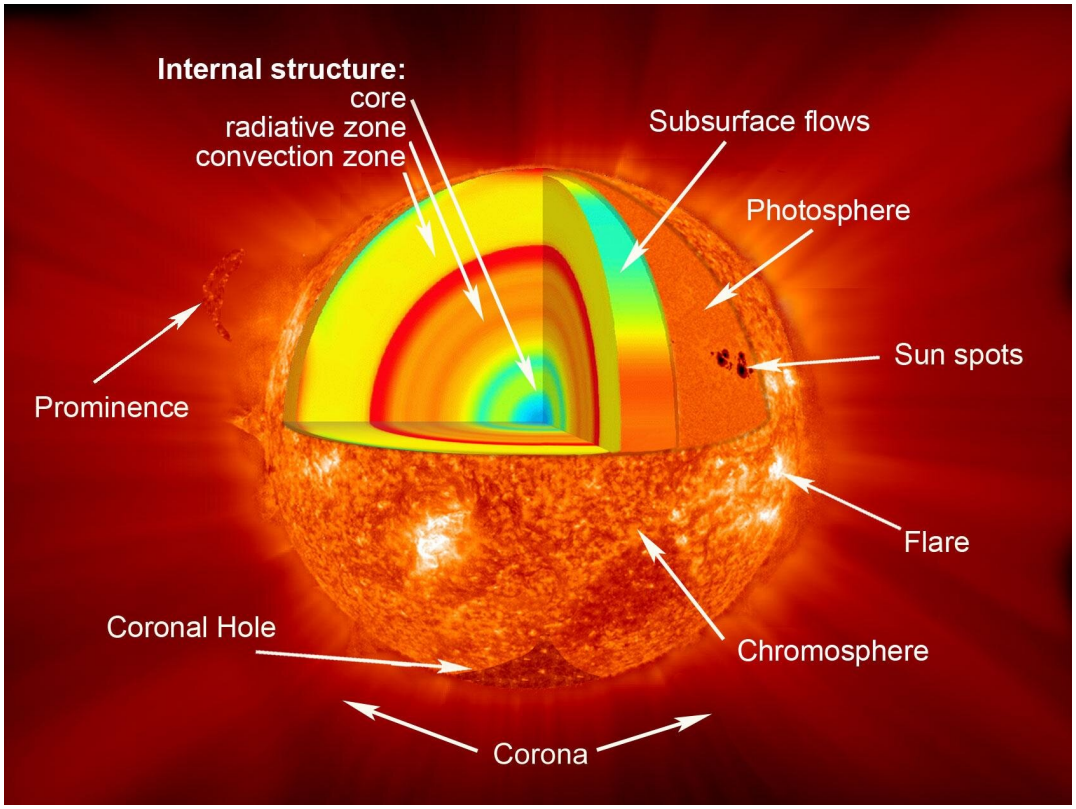
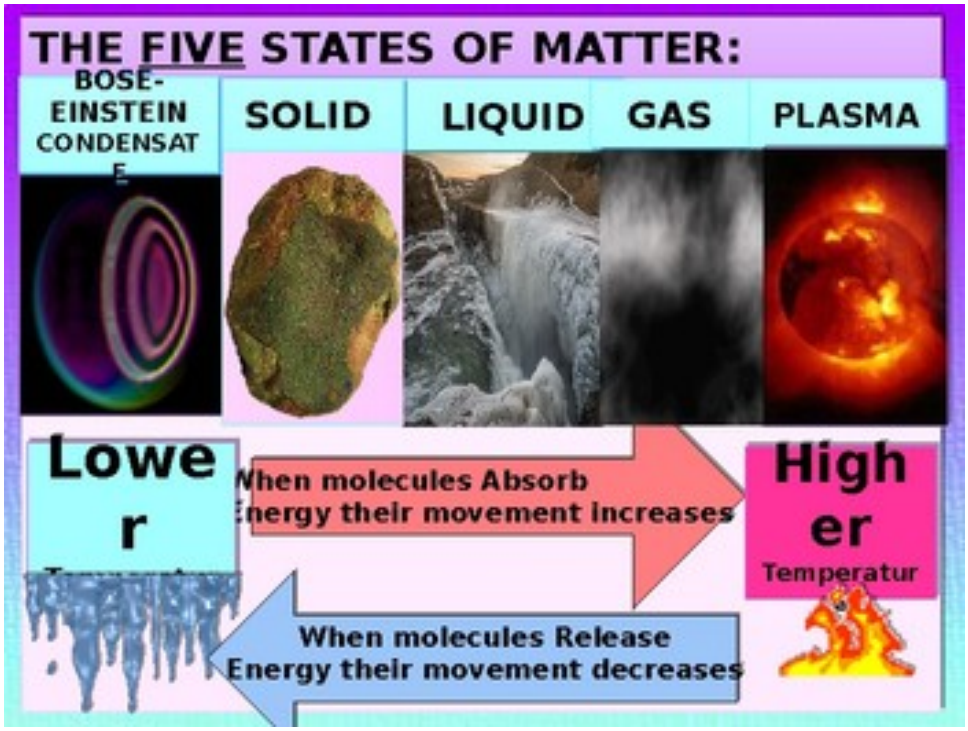


What is the finding?

- The scientists observed how paint **placed over bass audio speakers** ejected as a forest of jets when a certain sound frequency and amplitude (speaker's loudness) were surpassed.
    - When a **paint is placed above a speaker** and the music is turned on, the free **surface of the liquid becomes unstable** beyond a particular frequency and starts vibrating.
- The solar plasma can be **imagined as threaded by magnetic field lines**, much like the **long chains in polymer solutions.**
- They found that the underlying physics of **paint jets** when excited on a speaker is **analogous to the solar plasma jets.**
- The scientists elaborated that the plasma right below the visible solar surface **(photosphere) is perpetually in a state of convection**, much like boiling water in a vessel heated at the bottom.
    - This is ultimately powered by the **nuclear energy** released in the **hot-dense core.**

What is Plasma?

- Plasma is a hot, charged gas made of **positive ions and free-moving electrons** that has unique properties distinct from solids, liquids and gases.
- At high temperatures, electrons are **ripped from atom's nuclei and become a plasma** or an ionised state of matter.
- Plasma is also known as the **fourth state of matter.**



Source: PIB