Jupiter’s invisible shield

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Why in News?

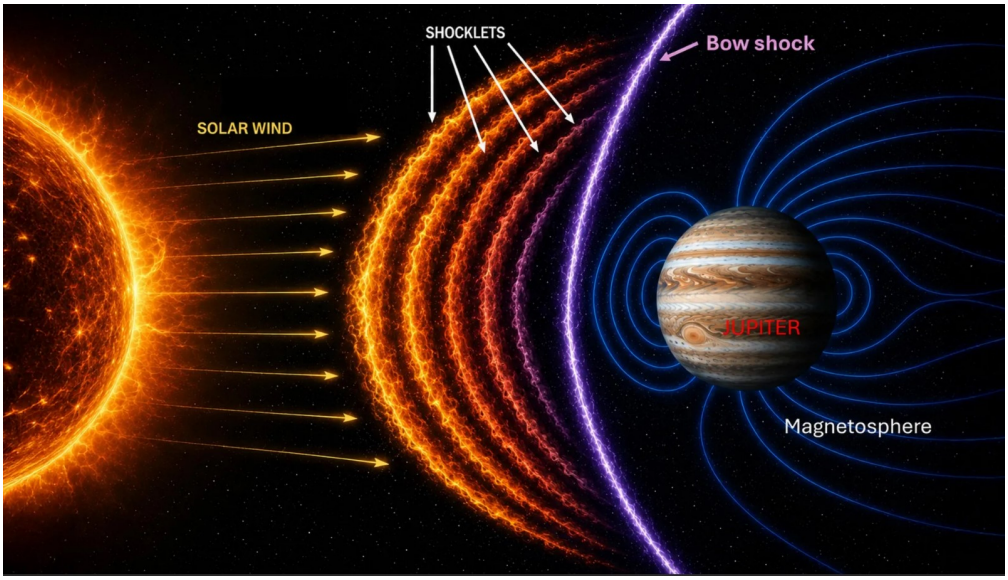
NASA’s Juno spacecraft discovered that Jupiter’s invisible magnetic shield (its bow shock and magnetosphere) is far larger and more complex than Earth’s.

Working of Jupiter’s Shield vs. Earth’s Shield

- **Bow Shock & Solar Wind Defense–** When the **solar wind** (a stream of charged particles from the Sun) hits a planet with a magnetic field, a **bow shock** forms to slow down, heat, and deflect the particles.
- **Multi-Frequency Plasma Waves–** Earth’s bow shock relies mostly on plasma waves concentrated around a single frequency.
- Jupiter’s bow shock uses stronger plasma waves with rich **harmonic structures** (multiple frequencies) to manage and convert solar wind energy.
- **Shocklets–** Jupiter features smaller extra shock structures called **shocklets** that act *before* the main bow shock to slow down the solar wind in an extra step Earth does not need.
- **Massive Scale & Power–** Jupiter’s magnetic field is roughly **20,000 times stronger** than Earth’s and stretches millions of miles into space (with a magnetosphere extending out about 7 million km).
- It is generated deep inside the planet by a massive layer of rotating, electrically conducting metallic hydrogen.

Why This Matters

Studying Jupiter's complex shield—observed via Juno’s **Waves** instrument—gives scientists a natural laboratory to understand giant cosmic shock waves and high-energy particle acceleration in deep space, such as those around exploding stars (supernova remnants).



Reference

Science Daily| Jupiter’s invisible shield

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