New Method to Estimate Helium Abundance in the Sun

Prelims – *Current events of national and international importance.*

Why in news?

Recent Study conducted by researchers from the Indian Institute of Astrophysics (IIA), reliably estimate Helium abundance in the Sun.

- **Helium** – It is the *2nd most abundant* element in the Sun after Hydrogen.
- But the accurate measurement of helium abundance in the Sun's photosphere has been a longstanding challenge.
- Traditional estimates relied on *indirect methods*, such as:
  - Extrapolation from hotter stars.
  - Measurements from the solar corona and solar wind.
  - Seismology studies of the Sun's interior.
- **Reason** - Helium does ***not produce observable spectral lines*** from the Sun's visible surface (photosphere).

New Methodology

- They analyzed *high-resolution solar spectrum data* from
  - Neutral magnesium (Mg) atomic lines and magnesium hydride (MgH) molecular lines.
  - Neutral carbon (C) atomic lines and hydrocarbon (CH and C_2) molecular lines.
- **Relative consistency** - The technique is based on the principle of *elemental abundance consistency* between atomic and molecular forms of the same element.

Key Findings

- The research confirmed a helium-to-hydrogen ratio of approximately 0.1.
- It also confirmed that for *every 10 hydrogen atoms* in the Sun, there is about 1 helium atom.

Significance

- This could be a major step in assessing the opacity of the Sun’s photosphere.
- Validates previously assumed helium abundance values with direct evidence.
- Estimating accurate models of solar structure and evolution, as helium content significantly influences a star's lifetime, energy production, and evolutionary path.
- Solar helium measurements help constrain theories about Big Bang nucleosynthesis and the early universe's elemental production.

Reference

PIB| New Method to Reliably Estimate Helium Abundance in the Sun

