



# Astronomers Uncover Hot Helium Stars

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## Why in News?

Astronomers have recently identified a group of **hot, helium-covered stars found in binary systems**, potentially deepening our understanding of stellar dynamics and evolution.

## What are the Major Outcomes of the Discovery?

- Utilising a telescope capable of detecting **ultraviolet light**, astronomers observed around half a million stars in the **Large and Small Magellanic Clouds**.
  - The **Large Magellanic Cloud** and the Small Magellanic Cloud are two **dwarf galaxies** that are companions to the **Milky Way**.
- Some stars exhibited **unusual speeds**, hinting at the presence of companions (binary nature) affecting their motion.
  - Subsequent analysis of the optical spectra of 25 stars revealed their elemental composition, leading to the identification of **different star classes**.
- Stars were categorised into three classes:
  - **Class 1 (helium-rich, hydrogen-depleted)**
  - **Class 2 and Class 3 (helium-rich, with hydrogen)**

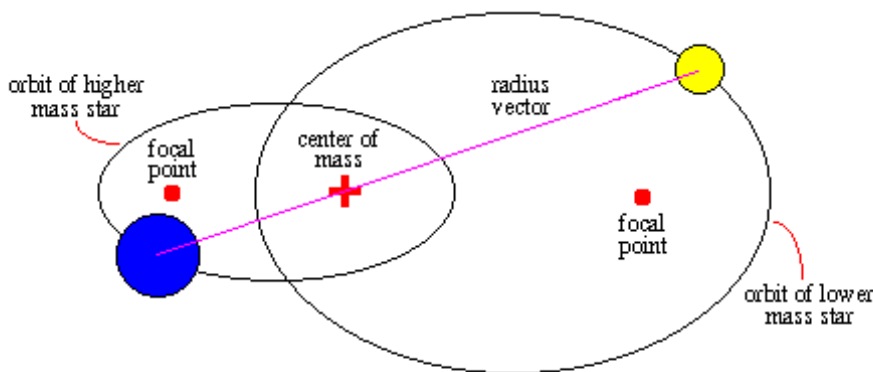
## What is the Binary System of Stars?

- **About:** It refers to the pair of stars that are **gravitationally bound to each other** and orbit around a **common centre of mass**.
  - An estimated 85% or more of stars are actually part of binary or even multiple-star systems.
- **Classification:**
  - **Visual Binaries:** These are the **easiest to identify and consist of two stars** that can be directly resolved and separated using a telescope.
  - **Spectroscopic binaries:** These stars are too close together to be resolved visually even with powerful telescopes.
    - However, their presence can be detected by observing periodic shifts in their spectral lines.
  - **Eclipsing Binaries:** These binary systems are aligned in a way that one star periodically passes in front of the other from our perspective.
    - This event creates a **temporary dip in the brightness of the combined system**, allowing astronomers to confirm the presence of the unseen companion and study its properties.

- **Astrometric Binaries:** These binary systems are detected indirectly by measuring the **wobbling motion** of a single star.
  - This wobbling is caused by the gravitational pull of the unseen companion star.
- **Confirmation of Binary Systems:** When a star exhausts its fuel, gravity takes over, leading to a **supernova explosion** that strips its outer layers.
  - Some supernova lack **hydrogen**, suggesting pre-explosion stripping of the outer layer.
    - This can happen in binary systems, where **one star's gravity removes the outer hydrogen layer from its companion**, leaving behind a helium-rich star.
  - Astronomers have only found one such binary system so far.

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### Binary Star Orbit



### How do Stars Maintain their Presence Over Billions of Years?

- Stars maintain their presence over billions of years through a delicate balance between two opposing forces: **nuclear fusion** and **gravity**.
- For example, despite **Newton's Law of Universal Gravitation** suggesting the Sun's gravitational collapse, nuclear fusion at its core acts as a vital stabilising force.
  - **Nuclear Fusion involves** the merging of nuclei of light elements like **hydrogen and helium**, releasing substantial heat energy.
  - This energy, in turn, **creates internal pressure**, counteracting the gravitational force, thus maintaining equilibrium.
- Therefore, Stars like the **Sun sustain this balance between outward fusion energy and inward gravitational pull**, ensuring their enduring presence over billions of years.

### UPSC Civil Services Examination, Previous Year Question (PYQ)

#### Prelims:

**Q. The terms 'Event Horizon', 'Singularity', 'String Theory' and 'Standard Model' are sometimes seen in the news in the context of (2017)**

- (a) Observation and understanding of the Universe**

(b) Study of the solar and the lunar eclipses

(c) Placing satellites in the orbit of the Earth

(d) Origin and evolution of living organisms on the Earth

**Ans: (a)**

**Mains:**

**Q.**How does the Juno Mission of NASA help to understand the origin and evolution of the Earth? **(2017)**

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