



Blue Straggler Stars

For Prelims: Blue Straggler Stars, Indian Institute of Astrophysics, Astrosat, Red giant, White dwarf, Hertzsprung-Russell diagram

For Mains: Initiatives of Department of Science and Technology, Evolution of Stars

Why in the News?

Recently, Scientists at Indian **Institute of Astrophysics**, Bengaluru, have found support for one way to understand peculiarity about Blue Straggler Star.

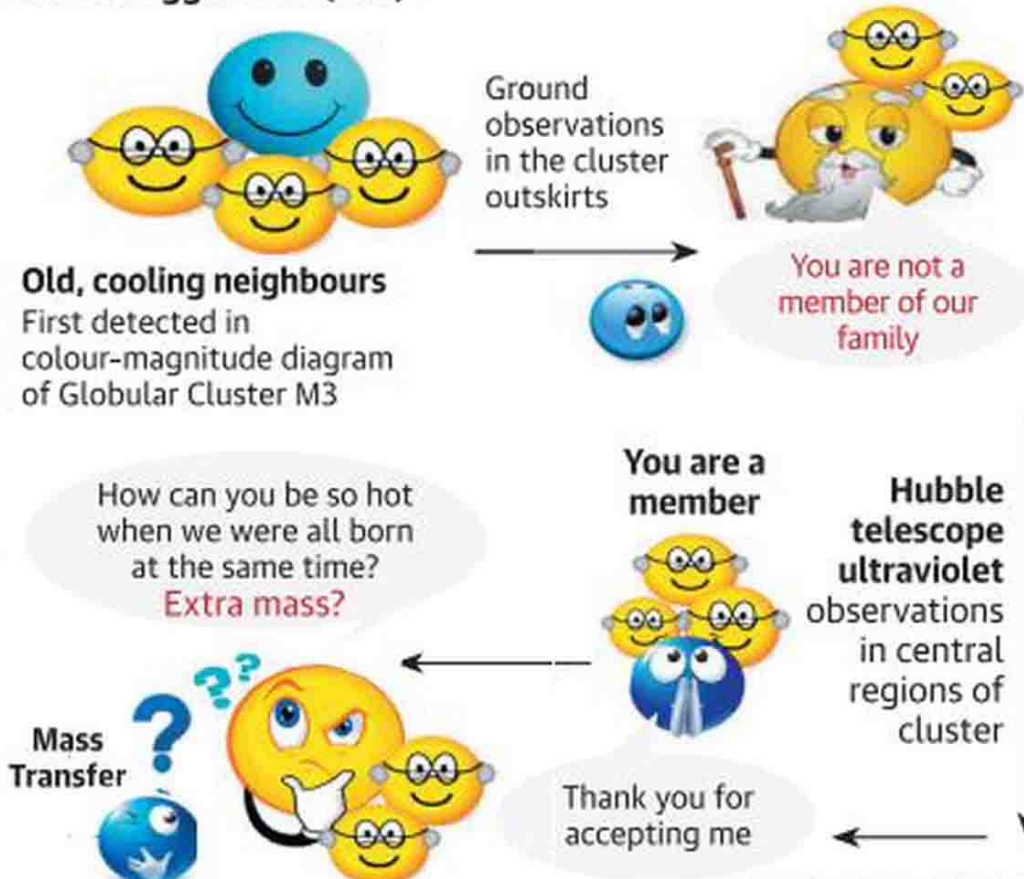
- The researchers made use of the observations by the **UVIT instrument (Ultraviolet Imaging Telescope) of [Astrosat](#)**, India's first science observatory in space.
- Earlier in September 2021, in the first-ever comprehensive analysis of [blue stragglers](#), Indian researchers had proposed a hypothesis for the evolution of blue straggler stars.

What are Blue Stragglers and How are they Different?

- Blue Straggler Star are hot, blue, massive stars and seem to have a **different trajectory of evolution from the norm**.
- There are a few stars that, when they are expected to start expanding in size and cooling down, **do just the opposite**.
- They **grow brighter and hotter** as indicated by their **blue color**.
 - Thus, standing out from the cooler red stars in their vicinity in the color-magnitude diagram.
- Since they lag their peers in evolution, they are called **stragglers**, more specifically, blue stragglers, because of their hot, blue color.
- **Allan Sandage** (an astronomer with Carnegie Observatories in Pasadena, California) discovered blue stragglers in the globular cluster M3 in **1952-53**.
- Most are located at least several thousand light-years away from the sun, and most are around 12 billion years old or more.
- The Milky Way's largest and **brightest globular is Omega Centauri**.

The puzzle posed by blue stragglers

Blue straggler star (BSS)



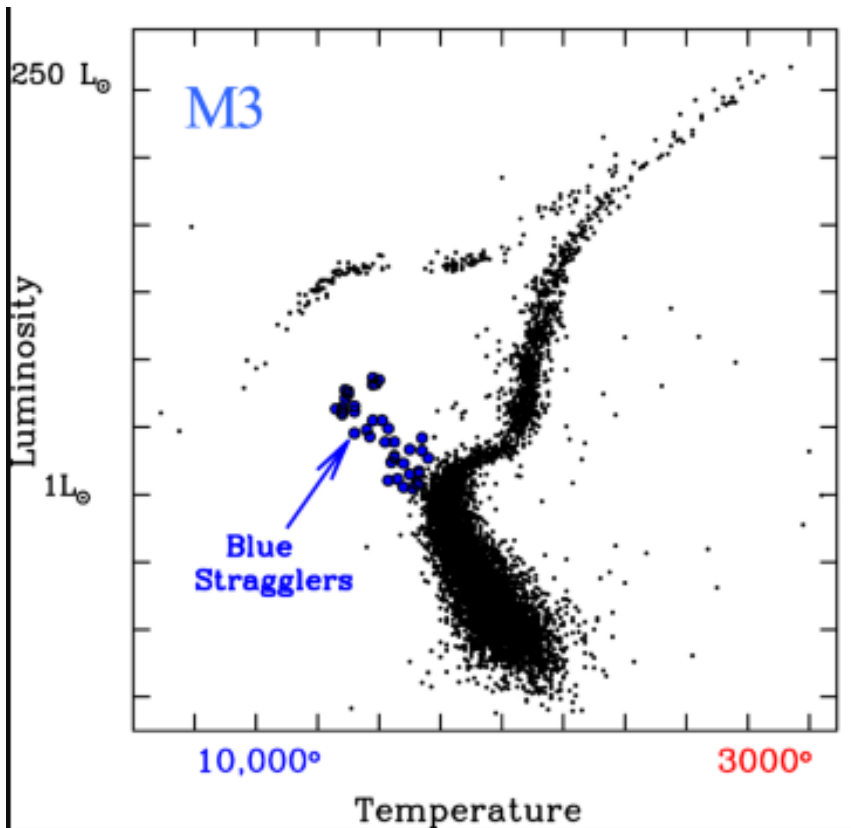
What are Possible Reasons for this peculiarity?

- **Possibility 1:** These **do not belong to the family of stars in the cluster**, and hence not expected to have the group properties.
- **Possibility 2:** if they belong to the group, **the evasive behavior is due to these stars gaining mass from a binary companion.**
 - In this second scenario, the straggler **draws matter from the giant companion star and grows more massive**, hot and blue, and the red giant ends up as a normal or smaller white dwarf.
 - In the research, the scientists found conclusive evidence of white dwarf companions to blue stragglers.
- **Possibility 3:** Straggler draws matter from a companion star, but there is a **third star that facilitates this process.**

How is the Age or Evolution of a Star Studied?

- To study the behavior of the star, **a graph of the color of a star against its magnitude is plotted.**
 - This gives an indication of **star's surface temperature**, which is related to the total energy given off by it.
 - If all the stars are done in a globular cluster, **many stars are seen to find a place within a band known as the main sequence.**
 - This graph is called the **Hertzsprung-Russell diagram.**
 - This diagram **plots the temperature of stars against their luminosity** or the color of stars against their absolute magnitude.
 - It **shows a group of stars in various stages of their evolution.**

- For example, our Sun is what is called a main sequence star.
 - Given its mass and age, it is **expected that once it has converted all its hydrogen into helium, its core will get denser**, while outer layers expand.
 - So, it will bloat into a **red giant**.
 - After this phase, its fuel is spent, it will shrink, becoming a smaller, cooling star called a **white dwarf** star at the end of its life.



What is Indian Institute of Astrophysics?

- The IIA with its headquarters in Bengaluru is an **autonomous Research Institute wholly financed by the [Department of Science and Technology](#)**, Government of India.
- IIA conducts research primarily in the areas of **astronomy, astrophysics and related fields**.
- It was **established in 1971**.

Source: TH