



RACE IAS

# Editorial

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## What makes blue straggler stars tick

### Context:

Blue stragglers are a class of stars on open or globular clusters that stand out as they are bigger and bluer than the rest of the stars.

They have intrigued scientists who have for long probed their origin.

**Carrying out the first-ever comprehensive analysis** of blue stragglers, Indian researchers recently found that half of the blue stragglers in their sample are formed through mass transfer from a close binary companion star.

It's not only humans who appear eccentric; **stars can have their own ideas of eccentricities**, too.

Scientists try to understand **their eccentricity** and, after studying them for long years, Indian Institute of Astrophysics, Bengaluru, researchers have found support for one way to understand their aberrant behaviour.

### Information about Blue Straggler Stars:

1. These are **unusually hot and bright stars** found in the cores of ancient star clusters known as
2. A clue to their origin is that they are **only found in dense stellar systems**, where distances between stars are extremely small (a fraction of a light year).
3. **Allan Sandage** (an astronomer with Carnegie Observatories in Pasadena, California) discovered blue stragglers **in the globular cluster M3** in 1952-53.

4. Most are located at least several thousand light-years away from the sun, and most are around 12 billion years old or more.
5. The Milky Way's largest and brightest globular is **Omega Centauri**.

### Scientists at Indian Institute of Astrophysics found support for one way to understand peculiarity about Blue Straggler Star:

1. The researchers made use of the observations by the UVIT instrument (Ultraviolet Imaging Telescope) of **Astrosat, India's first science observatory in space**.
2. 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.
3. Blue Straggler Star are **hot, blue, massive stars** and seem to have a different trajectory of evolution from the norm.
4. There are a few stars that, when they are expected to start expanding in size and cooling down, do just the opposite.
5. They grow brighter and hotter as indicated by their blue color.
6. Thus, standing out from the cooler red stars in their vicinity in the color-magnitude diagram.
7. Since they lag their peers in evolution, they are called stragglers, more specifically, blue stragglers, because of their hot, blue color.

### Stars classification and Stellar ageing:

1. To know what blue stragglers are, it is necessary to understand **how stars are classified and their evolution**, studied.
2. Our Sun, for example, is what is called a **main sequence star**, and, 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.
3. So, it will **bloat into a red giant**. After this phase, its fuel spent, it will **shrink**, becoming a smaller, **cooling star** called a **white dwarf star** at the end of its life.
4. To study the behaviour of the star, you could plot a graph of the **colour of a star**, which is an **indication of its surface temperature**, against its magnitude, which is related to the total energy given off by it.

5. If you do this for all the stars in a globular cluster, a large number of stars are seen to find a place within a band known as the main sequence.
6. Our Sun is a main sequence star, too, and the expectation is that all main sequence stars follow a pattern of evolution pretty much like our Sun's fate, which was described earlier.

### Reasons for Blue Stragglers behaviour:

1. There are a few stars that, just at the stage of their lives, when they are expected to start expanding in size and cooling down, **do just the opposite.**
2. They **grow brighter and hotter** as indicated by their blue colour, thus standing out from the **cooler red stars** in their vicinity in the colour-magnitude diagram.
3. Since they lag behind their peers in the evolution, they are called stragglers, more specifically, blue stragglers, because of their hot, blue colour.
4. The puzzle of why a blue straggler is more massive, and energetic, than it is expected to be may be resolved in several ways: One to simply show that these do not belong to the family of stars in the cluster, and hence not expected to have the group properties.
5. But if they actually belong to the group, the evasive behavior is due to **these stars gaining mass from a binary companion.**
6. In this second scenario, the straggler draws matter from the giant companion star and **grows more massive, hot and blue**, and the red giant to end up as a normal or smaller white dwarf.
7. The third possibility is that the **straggler draws matter from a companion star**, but that there is a third star that facilitates this process.
8. The IAP researchers have shown evidence that **supports the second of the hypotheses listed above.**

### Conclusion:

The study will help improve understanding of these stellar systems to uncover exciting results in **studies of large stellar populations**, including galaxies.

Following these findings, the researchers are conducting detailed analyses of individual blue stragglers in the catalogue to obtain their stellar properties.

Furthermore, interesting clusters and blue stragglers identified in this study will be followed up with ultraviolet imaging with **Ultra-Violet Imaging Telescope on AstroSat, India's first dedicated space observatory**, as well as the 3.6 m Devasthal Optical Telescope in Nainital.

The team carefully selected the target star clusters based on the likelihood of such stars present in them.

It was not an easy task to prove that these stragglers belong to the group. Not just this. It was also no mean task to choose objects that were **safe for collecting data using the sensitive UVIT**.

They developed unique tools to differentiate binary systems among the blue stragglers.

All of these took time, but the persistent study of the team consisting of several PhD students led to the conclusive evidence of **white dwarf companions to blue stragglers**.

## Freebie Politics in India

Recent news on the **collapse of the Sri Lankan economy** has engendered a fresh debate on the state's role. The government of Sri Lanka cut taxes across the board and provided several free goods and services. Consequently, the economy collapsed and the heavily-indebted country was left with no choice but to default on its commitments.

As a corollary, the **issue of freebies** given out by Indian states has come under the lens here. Over the years the **freebies** have become **an integral part of the politics in India**, be it for making promises in the electoral battles or providing free facilities to remain in power.

### What are Freebies?

- Political parties promise to offer **free electricity/water supply, monthly allowance** to unemployed, daily wage workers and women as well as gadgets like laptops, smartphones etc. in order **to secure the vote of the people**.
  - The states have become habituated to giving freebies, be it in the form of loan waivers or free electricity, cycles, laptops, TV sets and so on.
- Certain kinds of expenditure that are done under populist pressures or with elections in mind may be questionable.

- But given that in the last 30 years there has been **rising inequality**, some kind of **relief to the population in the form of subsidies may not be unjustified** but actually necessary for the economy to continue on its growth path.

### What are the Arguments in Favour of Freebies?

- **Facilitates Growth:** There are some examples which show that some expenditure outlays do have overall benefits such as the **Public Distribution System, employment guarantee schemes, support to education** and **enhanced outlays** for health, particularly during the pandemic.
  - These go a long way in increasing the productive capacity of the population and help build a healthier and a stronger workforce, which is a necessary part of any growth strategy.
  - The same goes for a State spending on education or health.
- **Boosts Industries:** States like Tamil Nadu and Bihar are known for giving women sewing machines, saris and cycles, but they buy these from budget revenues, **contributing to the sales of these industries**.
  - It can be considered a **boost for the supplier industry** and not a wasteful expenditure, given the corresponding production.
- **Essential for Fulfilling Expectations:** In a country like India where the states have (or don't have) a certain level of development, upon the emergence of the elections, there are **expectations from the part of people which are met by such promises** of freebies.
  - Moreover, there are also **comparative expectations** when the people of the adjoining/other states (with different ruling parties) get freebies.
- **Helps Lesser Developed States:** With the states that have comparatively lower level of development with a larger share of the population suffering from poverty, **such kind of freebies become need/demand-based** and it becomes **essential to offer the people such subsidies for their own upliftment**.

### What are the Downsides of the Freebies?

- **Macroeconomically Unstable:** Freebies undercut the basic framework of macroeconomic stability, the politics of freebies **distorts expenditure priorities** and **outlays remain concentrated on subsidies** of one kind or the other.

- **Impact on States' Fiscal Situation:** Offering freebies, ultimately, has an **impact on the public exchequer** and most of the **states of India do not have a robust financial health** and often have very limited resources in terms of revenue.
  - If states keep spending money for supposed political gains, their finances will go awry and **fiscal profligacy would prevail**.
  - As per the **Fiscal Responsibility and Budget Management (FRBM) rules** the **states can't borrow beyond their limits** and any deviation has to be approved by the Centre and central bank.
  - Therefore, while states have flexibility on how they choose to spend their money, **they cannot in ordinary conditions exceed their deficit ceilings**.
- **Against Free and Fair Election:** The promise of irrational freebies from public funds before elections unduly influences the voters, **disturbs the level playing field and vitiates the purity of the poll process**.
  - It amounts to an unethical practice that is **similar to giving bribes to the electorate**.
- **A Step Away from the Environment:** When the freebies are about giving free power, or a certain quantum of free power, water and other kinds of consumption goods, it **distracts outlays from environmental and sustainable growth**, renewable energy and more efficient public transport systems.
  - Moreover, it is a general human tendency to **use things in excess (thus leading to wastage of resources) when it is provided for 'free'**.
- **Debilitating Effect on Future Manufacturing:** Freebies **lower the quality and competitiveness of the manufacturing sector** by detracting from efficient and competitive infrastructure that enable high-factor efficiencies in the manufacturing sector.
- **Destroys Credit Culture:** Giving away **loan waivers** in the form of freebies may have undesired consequences such as destroying the whole credit culture and it blurs the very basic question as to why is it that a large majority of the farming community is getting into a debt trap repeatedly.

## What can be the Way Forward?

- **Realising Economic Impacts of Freebies:** It is not about how cheap the freebies are but **how expensive they are for the economy, life quality and social cohesion** in the long run.
  - We must strive instead for a **race to efficiency through laboratories of democracy** and **sanguine federalism** where states use their authority to harness innovative ideas and solutions to common problems which other states can emulate.
- **Judicious Demand-Based Freebies:** India is a large country and there is still a huge set of people who are below the poverty line. It is also **important to have all the people accommodated in the development plan** of the country.
  - The judicious and sensible offering of freebies or **subsidies that can be easily accommodated in the states' budget** do not do much harm and can be leveraged.
  - Ideally, a proportion of state expenditure should be earmarked to ensure better overall utilisation of resources.
- **Differentiating Subsidies and Freebies:** There is a need to understand the impacts of freebies from the economic sense and connect it with the taxpayers money.
  - It is also essential to distinguish between subsidy and freebies as **subsidies are the justified and specifically targeted benefits** that arise out of demands.
  - Although every political party has a right to create subsidy ecosystems to give targeted needy people the benefits, **there should not be a long-term burden on the economic health** of the state or the central government.