

Jellyfish galaxies

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Source: *The Hindu*

Manifest pedagogy: Amusements in the space and new discoveries or observations are of importance especially for Prelims. The evolution of universe, phenomena in the space and the new theories have to be learnt from the Mains perspective.

In news: Astrosat views star formation in jellyfish galaxies

Placing it in syllabus: Inventions in S&T

Static dimensions: Types of galaxies

Current dimensions:

- What is jellyfish galaxy?
- Comparison with other galaxies
- How tail is formed?
- Webb telescope

Content: Types of galaxies:

In **1936**, **Hubble** classified galaxies into **four main types**.



Spiral galaxies: More than two-thirds of all observed galaxies are spiral galaxies. A spiral galaxy **has a flat, spinning disk with a central bulge surrounded by spiral arms**. That spinning motion, at speeds of hundreds of kilometers a second, may cause matter in the disk to take on a distinctive spiral shape. E.g. Our Milky Way galaxy

Elliptical galaxies: They are generally round but can **stretch longer along one axis than along the other**, so much so that some take on a **cigar-like appearance**.

Elliptical galaxies may be very small, in which case they are called dwarf elliptical galaxies. They **contain many older stars, but little dust and other interstellar matter**. Their stars orbit the galactic center in more random directions. E.g. **Andromeda galaxy**.

Lenticular galaxies: They're called "lenticular" because they **resemble lenses**. Like spiral galaxies, they have a **thin, rotating disk of stars and a central bulge**, but they **don't have spiral arms**. They seem to form more often in densely populated regions of space. E.g. **Sombrero Galaxy**.

Irregular galaxies: These are galaxies that are not spiral, lenticular, or elliptical and **lack a distinct form**, often because they **are within the gravitational influence of other galaxies close by**. They are full of gas and dust, which makes them great nurseries for forming new stars. E.g. **Large and Small Magellanic Clouds**.

What is jellyfish galaxy?

- Recently Astrosat has observed a **jellyfish galaxy, JW100**, by using its Ultraviolet Imaging Telescope (UVIT).
- JW100 is located far away in the **galaxy cluster Abell 2626**.
- The star formation in JW100 was gauged using **observations of the visible (H-alpha) spectrum** using the **MUSE instrument of the Very Large Telescope in Chile and the UVIT**.
- Jellyfish galaxies are called so because they are **shaped like discs that have many tentacle-like arms streaming away from the disc**.

Astrosat is a part of an international programme called **GASP (Gas Stripping Phenomena in galaxies with MUSE)**, which is meant to **observe gas-stripping jellyfish galaxies using the MUSE Integral Field Spectrograph, Chile**. This programme is led

by Bianca Poggianti of Padova Observatory, Italy.

Comparison with other galaxies:

- Unlike usual galaxies that have stars forming in the disc, the jellyfish galaxies **have star formation in the tentacles** also.
- They are **different because of their orientation** as they are seen edge-on so that the **gas stripping can be seen perpendicular to one's field of vision.**

JW100 is different from other jellyfish galaxies such that star formation in other galaxies as estimated by the H-alpha observations matches with that calculated from ultraviolet observations. **In JW100, there is higher contribution from H-alpha but much less from ultraviolet in the tail.**

This could mean that other mechanisms such as shocks or thermal conduction from the hot plasma of the galaxy cluster is contributing to H-alpha emission from these regions.

How a tail is formed?

- They are **formed when a disc-shaped galaxy rams into a galaxy cluster** due to gravitational attraction of the cluster.
- Then the x-ray emitting **hot plasma in the cluster strips away the cold molecular gas of the disc**, causing it to stream behind like **tentacles**.

What triggers star formation in these environments is yet to be found out because in galaxy clusters the realm between the galaxies is filled with hot, tenuous gas which acts like a headwind and can remove gas and dust from the hapless galaxy. This process is known as **"ram pressure stripping."**

As galaxies run out of gas star formation stops. Thus galaxies in clusters stop forming new stars sooner than their relatives outside of clusters.

Once the **Webb telescope** is launched, it will **target sites of star formation** at different points along the tail and study those sites to learn more about conditions there.

Webb telescope:

- The **James Webb Space Telescope (JWST)** will be the world's premier space science observatory which will be launched on an Ariane 5 rocket from French Guiana in **2021**.
- Webb is an international project led by **NASA** with its partners, **ESA** (European Space Agency) and the **Canadian Space Agency**.
- Webb was **formerly** known as the **"Next Generation Space Telescope (NGST)"** and was renamed in September, 2002 after a former NASA administrator James Webb.
- The JWST's primary scientific mission has **four key goals:**
 - search for light from the first stars and galaxies that formed in the Universe after the Big Bang,
 - study the formation and evolution of galaxies,
 - understand the formation of stars and planetary systems,
 - study planetary systems and the origins of life.

These goals can be accomplished more effectively by observation in near-infrared light rather than light in the visible part of the spectrum. Hence **JWST's instruments will not measure visible or UV light** like the Hubble Telescope, but will have a much greater capacity to **perform infrared astronomy using Mid-Infrared Instrument (MIRI)**.