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ASTROSAT VIEWS STAR FORMATION IN JELLYFISH GALAXIES

Relevant for: Geography | Topic: The Earth and the Solar System

Colour composite: This JW100 image is created by combining three images. The red, green, blue colour scheme is assigned to image taken at each wavelength. | Photo Credit: Koshy George

Observations of a jelly fish galaxy, JW100, by Astrosat using its Ultraviolet Imaging Telescope have thrown up interesting puzzles. These puzzles involve star formation in hostile environments containing X-ray-emitting hot plasma. JW100 is located far away in the galaxy cluster Abell 2626. A recent work describes this analysis and poses the puzzle, vouching for the power of multiwavelength astronomy. The measurements made by the UVIT have been crucial for this work which is to be published in *The Astrophysical Journal.*

Jellyfish galaxies are called so because they are shaped like discs that have many tentacle-like arms streaming away from the disc. They are formed when a disc-shaped galaxy rams into a galaxy cluster, which is a dense region containing many hundreds or thousands of galaxies packed into a small region. This can happen when the galaxy is attracted by the gravitational attraction of the cluster. As the individual galaxy rams into the galaxy cluster, the cold gas in its disc interacts with the hot plasma in the cluster. Acting like a strong wind, the plasma in the cluster strips away the cold molecular gas of the disc, causing it to stream behind like tentacles. Unlike usual galaxies that have stars forming in the disc, the jellyfish galaxies have star formation in the tentacles also.

The European Southern Observatory has an international programme led by Bianca Poggianti of Padova Observatory, Italy, to observe 100 such gas-stripping jellyfish candidates using the MUSE Integral Field SpectrographChile. This programme is called GASP (Gas Stripping Phenomena in galaxies with MUSE).

Astrosat joins this effort by contributing data from its Ultraviolet Imaging Telescope (UVIT) instrument. “We have already acquired data of many jellyfish galaxies with UVIT and the quality of UV images are amazing,” says Koshy George who is working on UVIT data. Dr. George is currently with Ludwig-Maximilians-University, Munich, Germany and has been working on this since his post-doctoral term at Indian Institute of Astrophysics, Bengaluru.

The jellyfish galaxies’ tentacles contain a very hostile environment as they interact with the galaxy clusters that are rich in X-ray emitting hot plasma. “What triggers star formation in these environments is a puzzle,” says Dr George.

The jellyfish galaxies are being observed by various telescopes each sensitive to different parts of the electromagnetic spectrum. 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 ultraviolet imaging using the UVIT instrument of Astrosat.

One of the jellyfish galaxies that UVIT has collected data about is JW100. This galaxy is unusual because of its orientation. We see it edge-on so that the gas stripping can be seen perpendicular to our field of vision. It is also different from other jellyfish galaxies. In other jellyfish galaxies, star formation 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.

“Jellyfish galaxies experience several mechanisms at the same time. Many of these happen over various timescales. The paper attempts to throw light on some of these mechanisms in JW100, using data which trace various components,” says Annapurni Subramaniam, director of Indian Institute of Astrophysics who was not involved in this work.