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WHAT MAKES BLUE STRAGGLER STARS TICK

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It's not only humans who appear eccentric; stars can have their own ideas of eccentricities, too. One such case is that of blue stragglers, a particular type of star seen in clusters and also, sometimes, alone. 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. For this, the researchers also made use of the observations by the UVIT instrument (Ultra Violet Imaging Telescope) of ASTROSAT, India's first science observatory in space.

To know what blue stragglers are, it is necessary to understand how stars are classified and their evolution, studied. 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. 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.

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. 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. 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.

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. 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. Since they lag behind their peers in the evolution, they are called stragglers, more specifically, blue stragglers, because of their hot, blue colour.

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. But if they actually 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 to end up as a normal or smaller white dwarf. The third possibility is that the straggler draws matter from a companion star, but that there is a third star that facilitates this process.

The IIAP researchers have shown evidence that supports the second of the hypotheses listed above.

“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,” says Annapurni Subramaniam from IIAP in whose lab this work was done. 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,” she adds.

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