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Reaching for the stars

By Ashwin Khan, Pune Mirror | Jan 4, 2015, 02.30 AM IST



Varun Bhalerao (PHOTO BY DHANANJAY HELWADE)

An IUCCA astronomer studied data sent from NASA's satellite NuSTAR and made an important discovery related to binary neutron stars

City-based astronomer Varun Bhalerao is changing our understanding of stars. His study of the binary neutron star IGR J17544-2619 will help us understand how some stars function in the Milky Way. After analysing data obtained from NuSTAR, NASA's highly sophisticated space-based X-ray telescope, Bhalerao and his team had access to enough information to refute an earlier claim stating why celestial bodies like IGR J17544-2619 exhibit an unusual pattern of sporadic luminosity.

"An earlier study stated these binary neutron stars' high magnetic field was responsible for their irregular luminosity. There are a dozen or so of these stars in our galaxy displaying similar behaviour — from

a faint point of luminosity, they can go to a brighter state and vice versa in a matter of few minutes," says Bhalerao, a 31-year-old post-doctoral Vaidya-Raychaudhari Fellow at the Inter-University Centre for Astronomy and Astrophysics (IUCCA).

These binary neutron stars (a system of two stars in which one star revolves round the other or both revolve round a common centre) had amazed Bhalerao for the longest time. So he jumped at the opportunity to study one while completing his doctoral studies at the California Institute of Technology (Caltech). The project began in 2012 at Caltech, but the bulk of the research was completed at IUCCA in 2013.

Professor John Tomsick of Space Sciences Laboratory, University of California, Berkeley, one of Bhalerao's senior collaborators, explains what the research and its end result is all about: "The measurement of the neutron star magnetic field strength in this source is really an important result. It is a mystery why sources like IGR J17544- 2619 show unusually large and rapid changes in their X-ray brightness. While our result does not solve the mystery, it is a critical piece of the puzzle and rules out what was probably the leading explanation (an unusually high magnetic field strength).

"Next, it would be very useful to know the rotation rate of the neutron star. In most sources, that is seen through detection of periodic variations in the X-ray emission, but that measurement is proving difficult for this source, possibly because the random changes in the X-ray intensity are stronger than any periodic changes that might be present," adds Tomsick.

This breakthrough in solving a part of the cosmic puzzle wouldn't have been possible without NuSTAR, a satellite Bhalerao was involved in building from scratch. "I was a member of the team that built NuSTAR commissioned by NASA and Jet Propulsion Laboratory (JPL) in 2008. It was a Caltech-led project in which I was interested because of my passion for astronomy," says Bhalerao.

What's the significance of this discovery? "Fundamental research generally gives spillovers. For instance, when Einstein was working on the theory of relativity, he wasn't thinking how his study would aid inventions in the future. But years later, the technology that went into creating Global Positioning System (GPS) included Einstein's relativistic effects. Likewise, our research could prove to be useful many years later," smiles Bhalerao.

On a lighter note, he rubbishes myths attached with scientists, "Quite often than not, TV doesn't do justice in representing us authentically. Do you see anybody at IUCCA wearing white lab coats? I mean we aren't a genetically mutated breed, we just happen to know more because we study natural phenomenon in detail. People who are interested can do likewise as science is within the reach of everybody."

Given that there are other theories surrounding the sporadic brightness of some binary neutron stars, Bhalerao has asked for extended time to use NuSTAR for conducting further studies. Besides, his paper on the recent study of IGR J17544-2619 was accepted for peer review. But right now, he is already working on another major project. "I am a

part of the team that's building Astrosat, India's first dedicated astronomy satellite. I would also like to add that India isn't an underdog when it comes to space research, we are working at par with our contemporaries globally," he concludes.

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