Astronomers find answer to star formation slowdown

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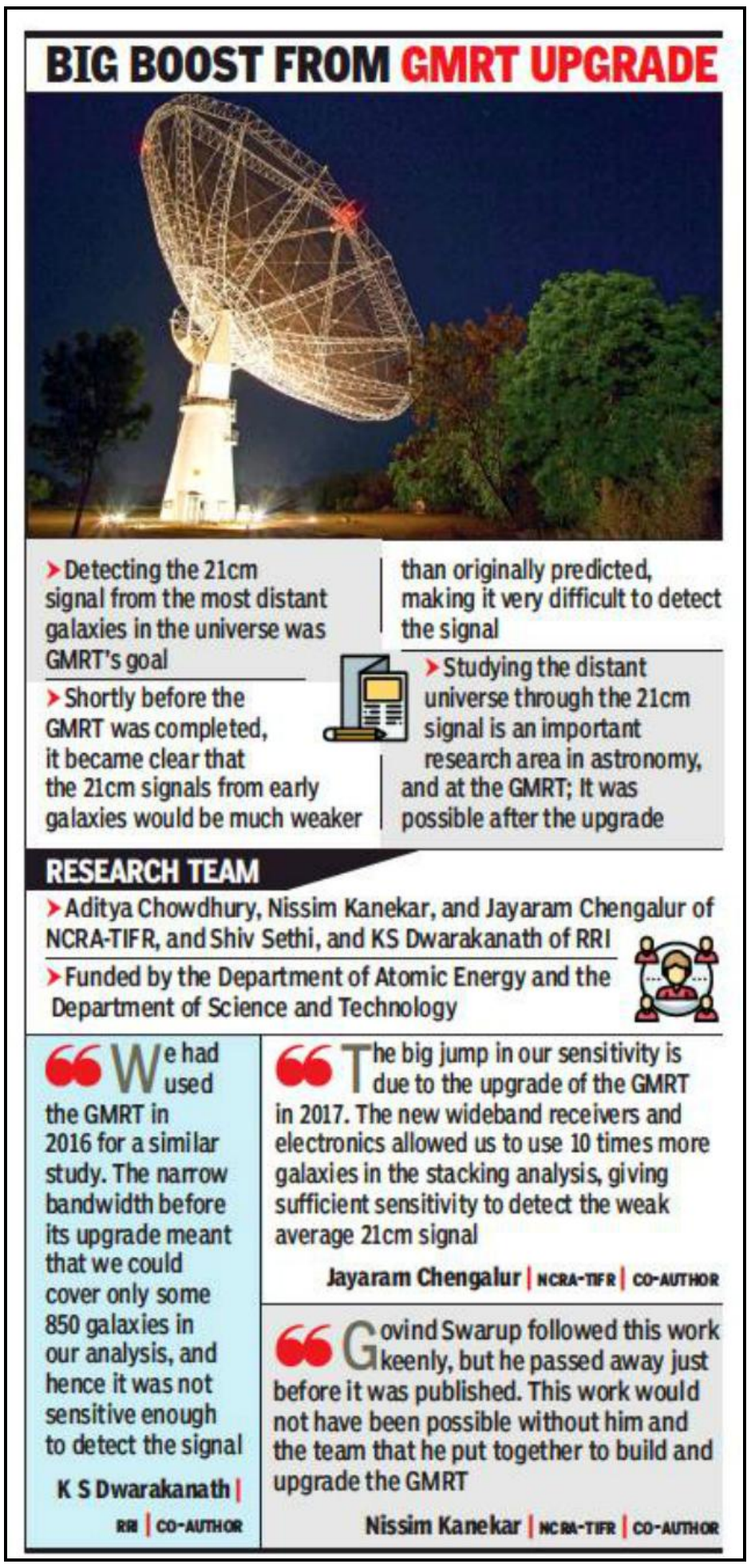
PUNE: The upgraded Giant Metrewave Radio Telescope (GMRT) helped a team of astronomers measure the atomic hydrogen content of galaxies as they were eight billion years ago to understand why star formation in the universe decreased steadily after peaking around that time.



The astronomers are from the National Centre for Radio Astrophysics in Pune, and the Raman Research Institute, Bengaluru.

The research paper that will be published on Thursday in Nature established that the the galaxies in their high star formation activity rapidly used up atomic hydrogen, the basic fuel for star formation.

The hydrogen then would have lasted only for the next 1-2 billion years, leading to a steady decrease in star formation later. A study of both hydrogen gas and the stars is necessary to understand a galaxy.

Studies have shown that star formation in galaxies was ten times higher eight billion years ago when compared to present times.

Aditya Chowdhury, a doctoral student at NCRA-TIFR, and the lead author of the study, said unlike the stars, which emit light strongly at optical wavelengths, the atomic hydrogen signal lies in the radio wavelength of 21cm, and can only be detected by radio telescopes.

“This 21cm signal is very weak, and difficult to detect from distant individual galaxies even with powerful telescopes like the upgrade GMRT. We overcome this limitation by using a technique called “stacking”. It combines the 21cm signals of nearly 8,000 galaxies identified earlier with optical telescopes. This method measures the average gas content of these galaxies,” he said.

It is known that star formation was intense in the early stages of the universe. The atomic gas in and around the galaxies would be consumed by star formation in just one or two billion years, he added.

“If galaxies cannot acquire more hydrogen from their surroundings, the star formation activity would decline, and finally, cease in these galaxies. Through our study, using the 21cm signal, we measured the mass of the atomic hydrogen in these galaxies and showed that the amount of hydrogen is enough to sustain star formation for only 1-2 billion years,” Chowdhury added.

The team used 90 hours of GMRT time for observation, but around six months to analysis the vast data.

The scientists involved in the study said the discovery is a tribute to Govind Swarup, father of radio astronomy in India, who set up GMRT.

He passed away in September.

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