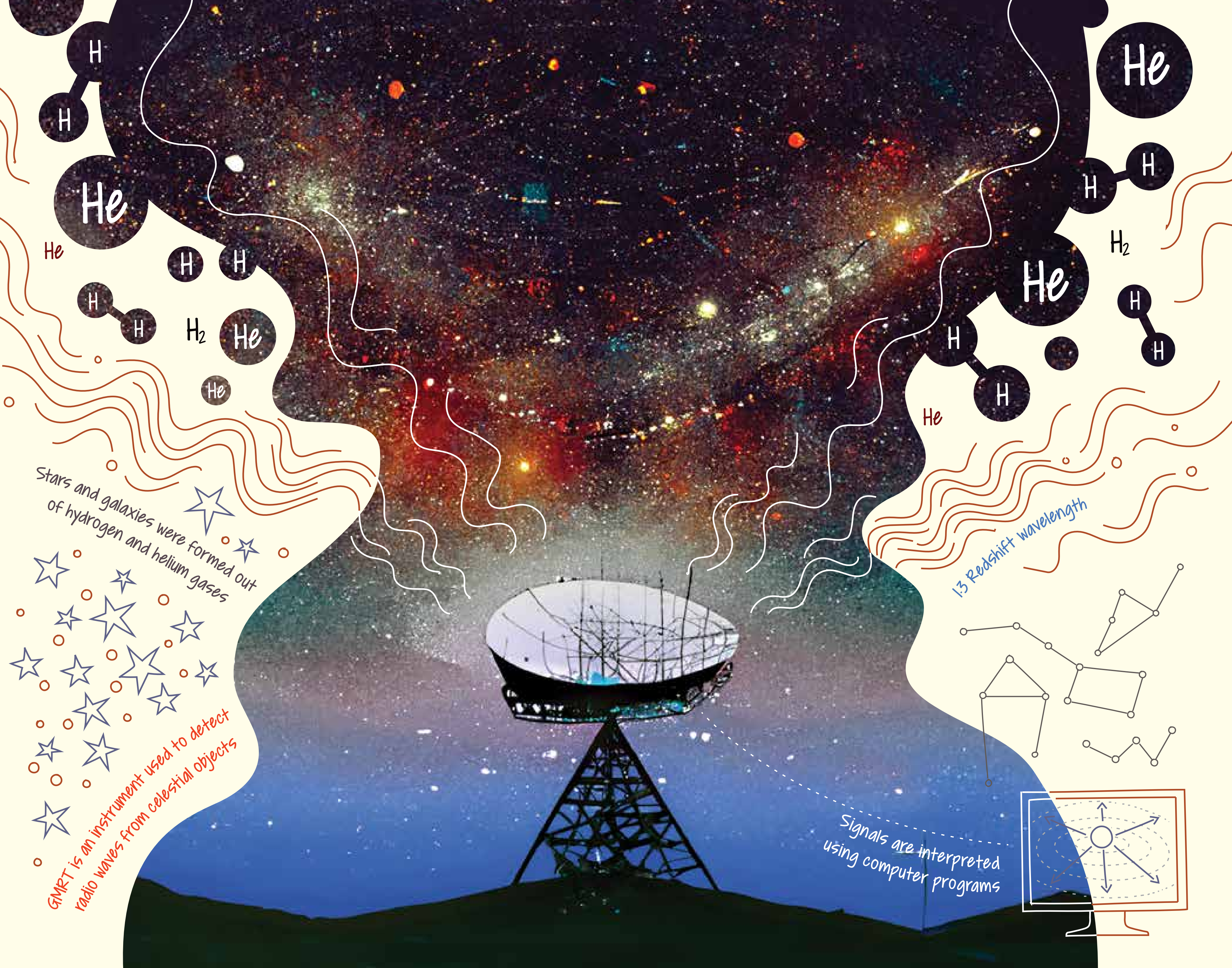
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Stars and galaxies were formed out of hydrogen and helium gases
1:3 Redshift wavelength
GMRT is an instrument used to detect radio waves from celestial objects
Signals are interpreted using computer programs

It all started with a big bang

The universe may end with a whimper as the poet said, but it began with a bang. And for a few hundred million years after the Big Bang, the universe was a place mostly filled with hydrogen and helium. It was a place in which stars and galaxies were beginning to form out of those gases.

Prof. Nissim Kanekar has been observing the vast expanses of space and trying to look back to a time 10 billion years after the Big Bang. What he found was fascinating. The period Prof. Kanekar and his collaborators studied is called the cosmic noon, when the star formation activity in the universe was at its peak.

Kanekar and his colleagues found that as the universe aged further, the hydrogen gas in galaxies was eaten up in star formation and galaxies were not able to acquire more gas from their surroundings. And so, the star formation activity in the universe slowed down. The universe as we know it now is a much quieter place than it was 10 billion years ago.

How did the team look so far back in time you may wonder. They used the Giant Metrewave Radio Telescope (GMRT). A radio telescope is an instrument used to detect radio waves from celestial objects. Radio telescopes use antennae to pick up signals from objects that are millions of light years away, much as one would use a radio to tune into a particular station. The signals are then interpreted using computer programs.

The GMRT, located a couple of hours outside the western Indian city of Pune, is an array or group of 30 telescopes. Nissim Kanekar and his colleagues measured the presence of atomic hydrogen gas in galaxies eight to nine billion years ago by studying the redshifted 21 cm line from these galaxies. This famous "spectral line" is redshifted to longer wavelengths due to the expansion of the universe, similar to the Doppler shift of train whistles when a train is moving away from us.

The team detected the presence of atomic hydrogen in galaxies at redshifts of 1-1.3 using the GMRT. This indicated that they were looking at galaxies as they were eight to nine billion years ago, a time when gas was being converted to stars at far higher rate than today. Galaxies also contained much more gas at those epochs relative to stars, but the gas was rapidly consumed in the process of star formation. As the amount of hydrogen gas in galaxies reduced, the rate of star formation reduced as well.

Prof. Nissim Kanekar's discoveries provide part of the answer to what was going on at cosmic noon, that has long fascinated astronomers. Separately, his studies have also yielded the best limits today on changes in two 'fundamental constants', the fine structure constant and the proton-electron mass ratio, two of the fundamental parameters that describe why our universe is the way it is.