Even galaxies are downsizing

The Hubble Ultra Deep Field. The Hubble Space Telescope sampled a tiny portion of space and saw 10,000 galaxies from the earliest eras of the Universe. New research suggests that these galaxies were much larger than the star forming galaxies of today. Image courtesy: NASA/ESA/S Beckwith (STScI) and the HUDF team.

The Universe around us is the result of galactic 'downsizing'; a term normally associated more with the world of business than astronomy.

Results from the Gemini Deep Deep Survey (GDDS) indicate that a large fraction of big galaxies mostly formed in the first half of the Universe's life (i.e. at high redshift). According to the researchers involved, the most active periods of star formation moved progressively from very massive galaxies early on to smaller, lower mass galaxies in the present time, which can maintain active star formation for longer by dint of their slower conversion of gas into stars.

"This downsizing scenario is contrary to the most popular models of galaxy formation," explains Sandra Savaglio, a member of the GDDS team. "The hierarchical model, which has been in vogue for many decades, predicts that big galaxies only formed in recent times through the merging of small galaxies."

The survey examined the so-called 'redshift desert', a high redshift area when the Universe was only between a quarter and half of its present age, and which is populated by extremely faint galaxies. The team found that not only were massive elliptical galaxies present but that both the stars and the gas in them were comparable in composition to the Sun, indicating that considerable evolution had already taken place.

According to Ken Freeman at the Australian National University, it is likely that conditions in the early Universe were conducive to the rapid formation of large systems: the density was high, there was a lot of gas and systems were coming together quickly. Smaller, more isolated, systems did not evolve so fast and eventually became today's lower-mass galaxies.

Though the downsizing scenario has been hypothesized before, this is one of the first times that astronomers have observed it in action. "It's astounding that so much happened so early," says David Crampton, another survey member. "The Universe really got its act together quickly to form these huge galaxies!"

Amarendra Swarup

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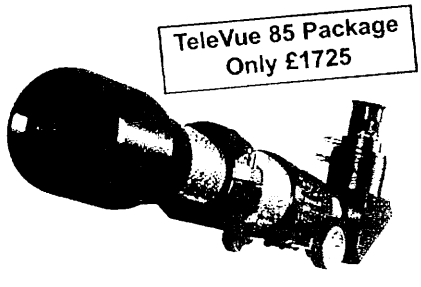

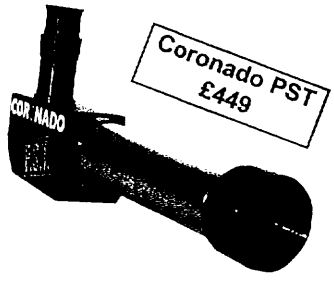

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