Star-birth myth 'busted' (w/ Podcast)

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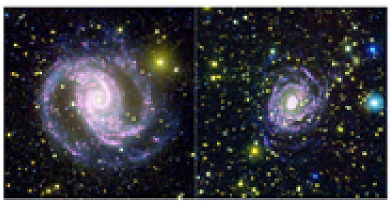

False-colour images of two galaxies, NGC 1566 (left) and NGC 6902 (right), showing their different proportions of very massive stars. Regions with massive O stars show up as white or pink, while less massive B stars appear in blue. NGC 1566 is much richer in O stars than is NGC 6902. The images combine observations of UV emission by NASA's Galaxy Evolution Explorer spacecraft and H-alpha observations made with the Cerro Tololo Inter-American Observatory (CTIO) telescope in Chile. NGC 1566 is 68 million light years away in the southern constellation of Dorado. NGC 6902 is about 33 million light years away in the constellation Sagittarius. Photo by: NASA/JPL-Caltech/JHU

(PhysOrg.com) -- An international team of researchers has debunked one of astronomy's long held beliefs about how stars are formed, using a set of galaxies found with CSIRO's Parkes radio telescope.

When a cloud of interstellar gas collapses to form stars, the stars range from massive to minute.

Since the 1950s astronomers have thought that in a family of new-born stars the ratio of massive stars to lighter ones was always pretty much the same — for instance, that for every star 20 times more massive than the Sun or larger, you'd get 500 stars the mass of the Sun or less.

"This was a really useful idea. Unfortunately it seems not to be true," said team research leader Dr Gerhardt Meurer of Johns Hopkins University in Baltimore.

The different numbers of stars of different masses at birth is called the 'initial mass function' (IMF).

Most of the light we see from galaxies comes from the highest mass stars, while the total mass in stars is dominated by the lower mass stars.

By measuring the amount of light from a population of stars, and making some corrections for the stars' ages, astronomers can use the IMF to estimate the total mass of that population of stars.

Results for different galaxies can be compared only if the IMF is the same everywhere, but Dr Meurer's team has shown that this ratio of high-mass to low-mass newborn stars differs between galaxies.

For instance, small 'dwarf' galaxies form many more low-mass stars than expected.

To arrive at this finding, Dr Meurer's team used galaxies from the HIPASS Survey (HI Parkes All Sky Survey) done with CSIRO's Parkes radio telescope.

"All of these galaxies were detected with the Parkes telescope because they contain substantial amounts of neutral hydrogen gas, the raw material for forming stars, and this emits radio waves," said CSIRO's Dr Baerbel Koribalski, a member of Dr Meurer's team.

Selecting galaxies on the basis of their neutral hydrogen gave a sample of galaxies of many different shapes and sizes, unbiased by their star formation history.

The astronomers measured two tracers of star formation, ultraviolet and H-alpha emissions, in 103 galaxies using NASA's GALEX satellite and the 1.5-m CTIO optical telescope in Chile.

H-alpha emission traces the presence of very massive stars called O stars, which are born with masses more than 20 times that of the Sun.

The UV emission, traces both O stars and the less massive B stars — overall, stars more than three times the mass of the Sun.

Meurer's team found that this ratio, of H-alpha to UV emission, varied from galaxy to galaxy, implying that the IMF also did, at least at its upper end.

Their work confirms tentative suggestions made first by Veronique Buat and collaborators in France in 1987, and then a more substantial study last year by Eric Hoversteen and Karl Glazebrook working out of Johns Hopkins and Swinburne Universities that suggested the same result.

"This is complicated work, and we've necessarily had to take into account many factors that affect the ratio of H-alpha to UV emission, such as the fact that B stars live much longer than O stars," Dr Meurer said.

Dr Meurer's team suggests the IMF seems to be sensitive to the physical conditions of the star-forming region, particularly gas pressure.

For instance, massive stars are most likely to form in high-pressure environments such as tightly bound star clusters.

The team’s results allow a better understanding of other recently observed phenomena that have been puzzling astronomers, such as variation of the ratio of H-alpha to ultraviolet light as a function of radius within some galaxies. This now makes sense as the stellar mix varying as the pressure drops with radius (just like the pressure varies with altitude on the Earth).

Importantly, the team also found that essentially all galaxies rich in neutral hydrogen seem to form stars.

“That means surveys for neutral hydrogen with radio telescopes will find star-forming galaxies of all kinds,” Dr Meurer said.

The Australian SKA Pathfinder, the next-generation radio telescope now being developed by CSIRO, will find neutral hydrogen gas in half a million galaxies, allowing a comprehensive examination of star-formation in the nearby universe.

Provided by CSIRO (news : web)

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