Astronomers Find Hundreds of Young, Distant Galaxy Clusters

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Astronomers have found the largest number of the most distant, youngest galaxy clusters yet, a feat that will help them observe the developing universe when it was less than half its current age and still in its formative stages.

The team of astronomers from the University of Florida, NASA's Jet Propulsion Laboratory and the Lawrence Livermore National Laboratory has found nearly 300 new galaxy clusters and groups, including nearly 100 at distances of eight to 10 billion light years. The new sample, a six-fold increase in the number of known clusters and groups at such extreme distances, will allow astronomers to study very young galaxies two-thirds of the way back to when the universe is believed to have originated in the Big Bang.

The team presented its findings yesterday in Calgary, Canada, at the American Astronomical Society's biannual meeting.

Anthony Gonzalez, an assistant professor of astronomy at UF and one of the team of astronomers who made the discovery, likened the view of the clusters to a glimpse at the Los Angeles basin when it was still home only to a collection of dusty, small towns. By knowing what the clusters looked like eight to 10 billion years ago, the astronomers will have a better idea of where and when the first stars and galaxies formed and how they grew and changed over the universe's full 13.7 billion- year lifespan.

“It would be like taking a snapshot of cities as they were near the beginning,” he said. “You’re watching everything fall together, so you can see some of the pieces, some of the little towns, before they become part of a giant city.”

Galaxy clusters are among the universe’s most dense places, similar to cities on Earth, and a single galaxy cluster can contain hundreds of large galaxies similar to our Milky Way.

The most massive, oldest galaxies tend to be found in galaxy clusters. This makes clusters the best place to look to determine when the first stars formed and how these galaxies grew with time. While individual galaxy clusters have previously been found at similar distances, this is the first time that such a large number of galaxy clusters has been detected so far away.

Gonzalez said the astronomers’ key step in finding the large number of clusters was to merge infrared data from NASA’s Spitzer Space telescope with existing deep optical imaging obtained by National Optical Astronomy Observatory Deep Wide-Field Survey team at Kitt Peak National Observatory in Arizona.

The team used the Spitzer telescope to make infrared mosaics, a process that was thousands of times faster than with the biggest ground-based telescopes because of the Spitzer telescope’s unique capabilities. The combined Kitt Peak and Spitzer data provided information on the distances to the galaxies, enabling the astronomers to weed out small, nearby galaxies whose light was cluttering the view between the observers and the most distant clusters. Gonzalez’s main role was to analyze the maps of massive galaxies and detect the hidden galaxy clusters.

“We’re basically getting rid of all the junk to isolate the most distant,

massive galaxies," Gonzalez said.

The research will allow astronomers to embark on several new studies, said Mark Brodwin, an astronomer at the Jet Propulsion Laboratory and the lead investigator on the team.

"Clusters of galaxies are the repositories of the most massive galaxies in the universe," he said. "As such, our survey serves as an ideal laboratory in which to study the process of massive galaxy formation over the last two-thirds of the lifetime of the universe."

The next step is to study the newly discovered galaxies in detail, Brodwin said. Astronomers want to learn more about their size, shape, mass and the rate at which they form new stars and merge together to form larger galaxies. "These key measurements will improve our fundamental understanding of the galaxy formation process," he said.

Source: University of Florida