

Jurassic Space: Ancient Galaxies Come Together After Billions of Years

February 18 2010



These four dwarf galaxies waited billions of years to come together, setting off a fireworks show as thousands of new star clusters come to life. The distorted galaxies are quickly producing massive, hot, young stars that are pumping out ultraviolet radiation, heating up surrounding gas clouds, and causing them to glow. Credit: NASA, ESA, S. Gallagher (The University of Western Ontario), and J. English (University of Manitoba)

(PhysOrg.com) -- Imagine finding a living dinosaur in your backyard. Astronomers have found the astronomical equivalent of prehistoric life in our intergalactic backyard: a group of small, ancient galaxies that has waited 10 billion years to come together. These "late bloomers" are on their way to building a large elliptical galaxy.

Such encounters between dwarf galaxies are normally seen billions of light-years away and therefore occurred billions of years ago. But these galaxies, members of Hickson Compact Group 31, are relatively nearby, only 166 million light-years away.

New images of this foursome by NASA's [Hubble Space Telescope](#) offer a window into the universe's formative years when the buildup of large galaxies from smaller building blocks was common.

Astronomers have known for decades that these dwarf galaxies are gravitationally tugging on each other. Their classical spiral shapes have been stretched like taffy, pulling out long streamers of gas and dust. The brightest object in the Hubble image is actually two [colliding galaxies](#). The entire system is aglow with a firestorm of star birth, triggered when [hydrogen gas](#) is compressed by the close encounters between the galaxies, and collapses to form stars.

The Hubble observations have added important clues to the story of this interacting group, allowing astronomers to determine when the encounter began and to predict a future merger.

"We found the oldest stars in a few ancient globular star clusters that date back to about 10 billion years ago. Therefore, we know the system has been around for a while," says astronomer Sarah Gallagher of The University of Western Ontario in London, Ontario, leader of the Hubble study. "Most other [dwarf galaxies](#) like these interacted billions of years ago, but these galaxies are just coming together for the first time. This encounter has been going on for at most a few hundred million years, the blink of an eye in cosmic history. It is an extremely rare local example of what we think was a quite common event in the distant universe."

Everywhere the astronomers looked in this group they found batches of infant star clusters and regions brimming with [star birth](#). The entire

system is rich in hydrogen gas, the stuff of which stars are made. Gallagher and her team used Hubble's Advanced Camera for Surveys to resolve the youngest and brightest of those clusters, which allowed them to calculate the clusters' ages, trace the star-formation history, and determine that the galaxies are undergoing the final stages of galaxy assembly.

The analysis was bolstered by infrared data from NASA's Spitzer Space Telescope and ultraviolet observations from the Galaxy Evolution Explorer (GALEX) and NASA's Swift satellite. Those data helped the astronomers measure the total amount of star formation in the system. "Hubble has the sharpness to resolve individual star clusters, which allowed us to age-date the clusters," Gallagher adds.

Hubble reveals that the brightest clusters, hefty groups each holding at least 100,000 stars, are less than 10 million years old. The stars are feeding off of plenty of gas. A measurement of the gas content shows that very little has been used up — further proof that the "galactic fireworks" seen in the images are a recent event. The group has about five times as much hydrogen gas as our Milky Way Galaxy.

"This is a clear example of a group of galaxies on their way toward a merger because there is so much gas that is going to mix everything up," Gallagher says. "The galaxies are relatively small, comparable in size to the Large Magellanic Cloud, a satellite galaxy of our Milky Way. Their velocities, measured from previous studies, show that they are moving very slowly relative to each other, just 134,000 miles an hour (60 kilometers a second). So it's hard to imagine how this system wouldn't wind up as a single [elliptical galaxy](#) in another billion years."

Adds team member Pat Durrell of Youngstown State University: "The four small galaxies are extremely close together, within 75,000 light-years of each other — we could fit them all within our Milky Way."

Why did the galaxies wait so long to interact? Perhaps, says Gallagher, because the system resides in a lower-density region of the universe, the equivalent of a rural village. Getting together took billions of years longer than it did for galaxies in denser areas.

Hickson Compact Group 31 is one of 100 compact galaxy groups catalogued by Canadian astronomer Paul Hickson.

Gallagher's results appear in the February issue of the *Astronomical Journal*.

Provided by University of Western Ontario

Citation: Jurassic Space: Ancient Galaxies Come Together After Billions of Years (2010, February 18) retrieved 9 April 2024 from <https://phys.org/news/2010-02-jurassic-space-ancient-galaxies-billions.html>

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