Science News

Galaxy Collision Debris As A Laboratory To Study Star Formation

ScienceDaily (Jun. 3, 2008) — An international team of researchers led by Médéric Boquien of the University of Massachusetts Amherst has shown that debris formed when two galaxies collide makes a simpler, more accessible laboratory for studying the process of star formation.

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"Surprisingly, we found that star formation is essentially the same in galaxies and in the debris which occurs between galaxies, in spite of tremendous differences in the environment," says Boquien, a post-doctoral researcher in the astronomy department. "This is a very exciting result, meaning that we can use these regions, which are located outside a pre-existing stellar disk and are much simpler than star forming regions in galaxies, to study the creation of stars."

Additional members of the team include Pierre-Alain Duc of the National Center for Scientific Research in France, Frédéric Bournaud of the French Atomic Energy Commission, Jonathan Braine of the Bordeaux Observatory, Vassilis Charmandaris of the University of Crete, Greece and Ute Lisenfeld at the University of Granada, Spain.

Collision debris is the remains of a collision between two or more galaxies, in which the interplay of gravity can create long expanding "tidal tails." This debris, which is ejected into the intergalactic medium located between galaxies, is composed mainly of gas and dust stripped from their parent galaxies. They can be as heavy as several billion suns, and serve as a reservoir that feeds star formation. The most massive of these star forming regions, called tidal dwarf galaxies, can be bound by their own gravity and rotate.

Barely studied since their discovery in the 1950s, these areas have sparked increasing interest from astronomers, and were recently used to test the nature of dark matter. What was not known was whether star formation was the same in collision debris as it was in galaxies, a key factor in determining their usefulness in the study of star formation.

To answer this question, Boquien and his team observed a carefully selected sample of six interacting galaxy systems located a distance of 55 to 375 million light years from Earth. The study focused on extreme systems in which a large fraction (up to 85%) of star formation takes place in collision debris, rather than in the main body of the parent galaxies, a situation that is representative of the distant, young Universe.

By simultaneously analyzing multiple wavelengths of emissions, including infrared radiation from the dust heated by young stars picked up by the Spitzer space observatory, the team was able to trace star formation and determine that the process was occurring in essentially the same way in the intergalactic medium and inside galaxies. Ultraviolet energy detected by the Galaxy Evolution Explorer and images of ionized hydrogen atoms and optical and infrared light from eight ground-based telescopes were also used.

"The best regions to study stellar evolution would be those completely devoid of old stars, and we were able to find some regions which satisfy this criteria," says Boquien, who adds that these regions are generally quite isolated, unlike star forming regions in galaxies which can be surrounded by many bright astronomical objects. "As star formation apparently occurs in a similar way in galaxies, results we obtain studying intergalactic star forming regions can be confidently extended to galaxies."

The team presented their results June 2 at the American Astronomical Society meeting in St. Louis, Missouri.

Adapted from materials provided by University of Massachusetts Amherst.

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