

Ultra-High-Resolution Galaxy Formation

Science Mission Directorate

Continuing our long-term work in understanding how the first stars and galaxies formed, we have achieved unprecedented high-resolution (3 parsec) cosmological simulations. These self-consistent simulations resolve—for the first time—star formations in a large cosmological volume.

In our simulations, feedback from star formations is properly treated, because the Sedov and subsequent phases of the evolution of supernova remnants are adequately resolved. The simulations produce galactic winds driven by supernovae in a fashion similar to what is observed, strongly validating the physical realm of the simulations.

Characteristics of the simulated galaxies help to interpret how they changed over time into the objects recognized in the present universe. Our work will also help to understand future observations of the most distant galaxies, in support of NASA's James Webb Space Telescope, a large, infrared-optimized space telescope scheduled for launch in 2014.

NASA's Pleiades and Columbia supercomputers enable our very large simulations, which would otherwise not be possible. Visualizations of the simulation data, provided by experts at the NASA Advanced Supercomputing (NAS) facility, help us interpret and understand the data.

*Renyue Cen, Princeton University
cen@astro.princeton.edu*

This image shows two galaxies in the process of merging, and how gas accretes onto galaxies through complex, spiral-arm-like streams. The smaller galaxy at lower right just had a close passage around the larger galaxy.

Su Simon, Princeton University

