Center for Computational Sciences, University of Tsukuba
www.ccs.tsukuba.ac.jp

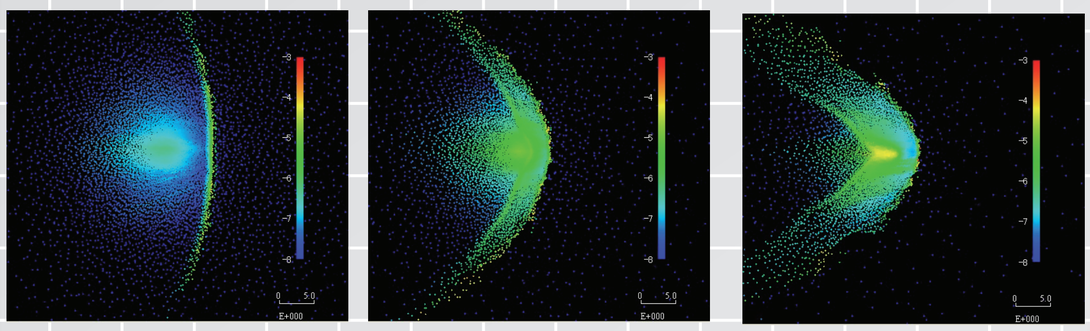
FIRST
The Origin of FIRST Generation Objects

Simulations with FIRST

The FIRST cluster allows us to perform large-scale simulations on the formation of first stars as well as first galaxies and the development of structure in the universe. Also, 6D collisionless Boltzmann calculations for dark matter dynamics can be realized.

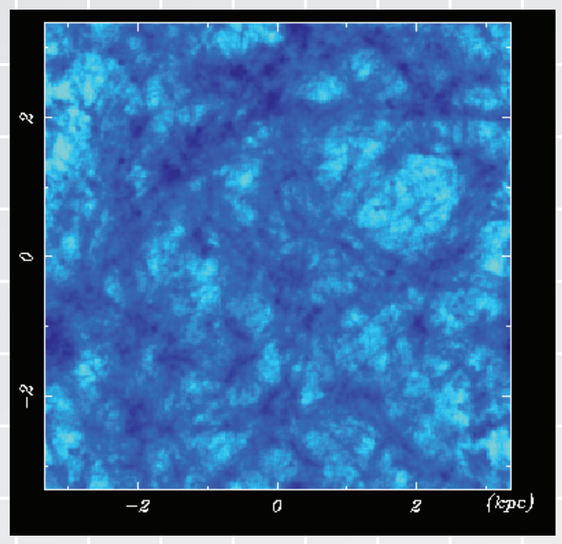
First stars

The star formation in first generation objects is regulated by ionizing and photodissociating radiation emitted from previously formed stars. Such regulation should be explored by radiation hydrodynamics (RHD) with careful treatment of radiation transfer. A RHD simulation with FIRST has revealed that subsequent star formation is possible after the formation of a very first star.



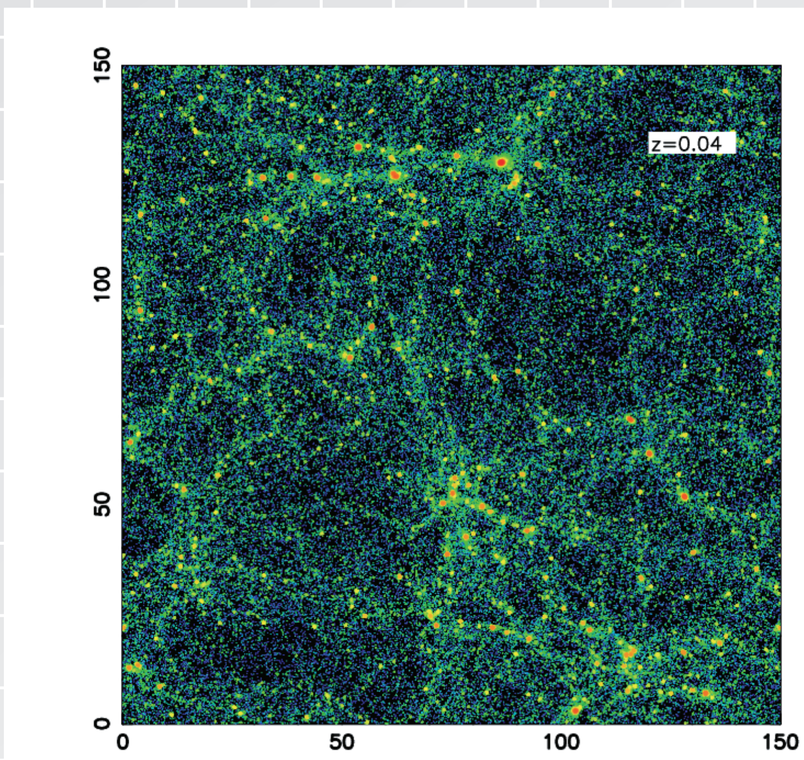
First galaxies

The first chemical enrichment with heavy elements in the universe is thought to be brought by supernova explosions in first galaxies. A hydrodynamic simulation with 256^3 grids shows that the chemical enrichment proceeds in a highly inhomogeneous manner.



Structure in the Universe

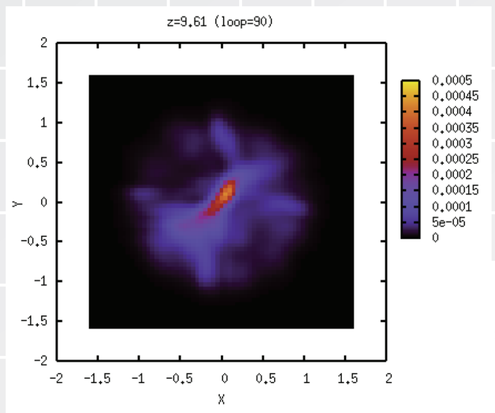
With the formation of galaxies, a large-scale structure develops in the universe through the gravitational instability of dark matter. A simulation with 16.77 million dark matter particles and gas particles of the same number shows the formation of hierarchical structure including galaxy clusters.



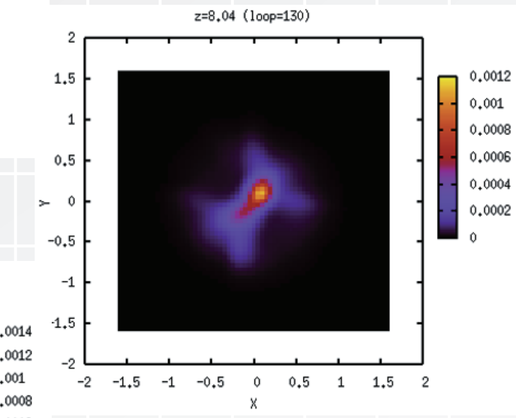
6D Boltzmann

By solving 6-dimensional collisionless Boltzmann equation, the collisionless dynamics of dark matter can be treated more properly than N-body simulations. The FIRST cluster allows us to directly solve 6D collisionless Boltzmann equation. This is a challenging attempt to investigate the dark matter dynamics with a fundamentally physical method.

I



II



III