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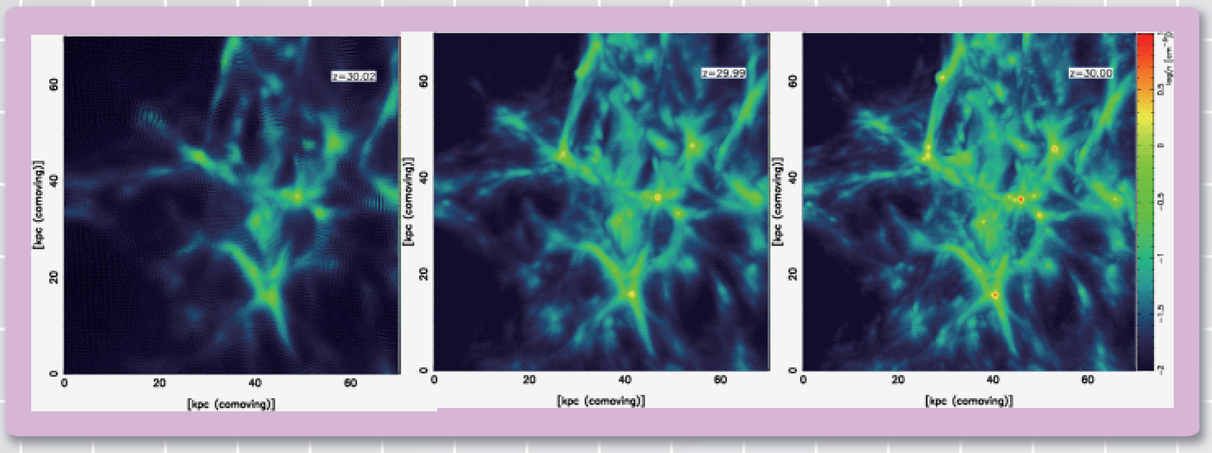
FIRST
The Origin of FIRST Generation Objects

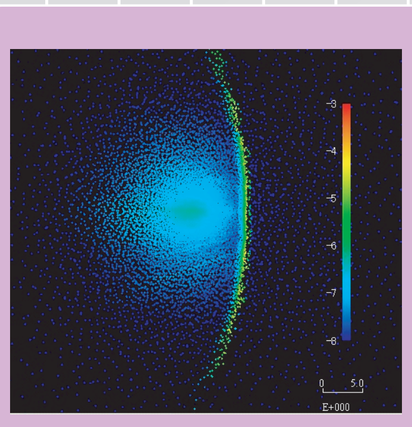
Astrophysical Simulations (1)

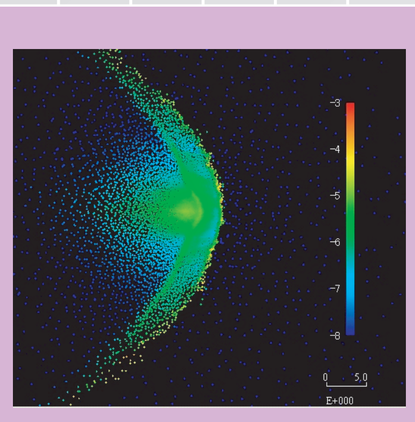
First star formation

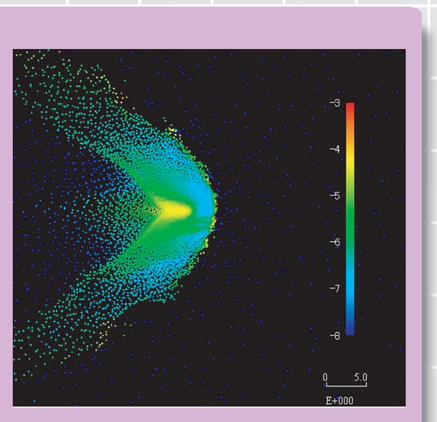
In order to investigate the formation of first stars, we have performed cosmological *N*-body/hydrodynamic simulations including radiative heating/cooling and chemical reactions. Using the *FIRST* simulator, we have explored the dependence on the numerical resolution with 100 million of dark matter and gas particles at maximum. As a result, we have found that the collapse of density peaks depends on the dark matter cusps resolved.



First star feedback



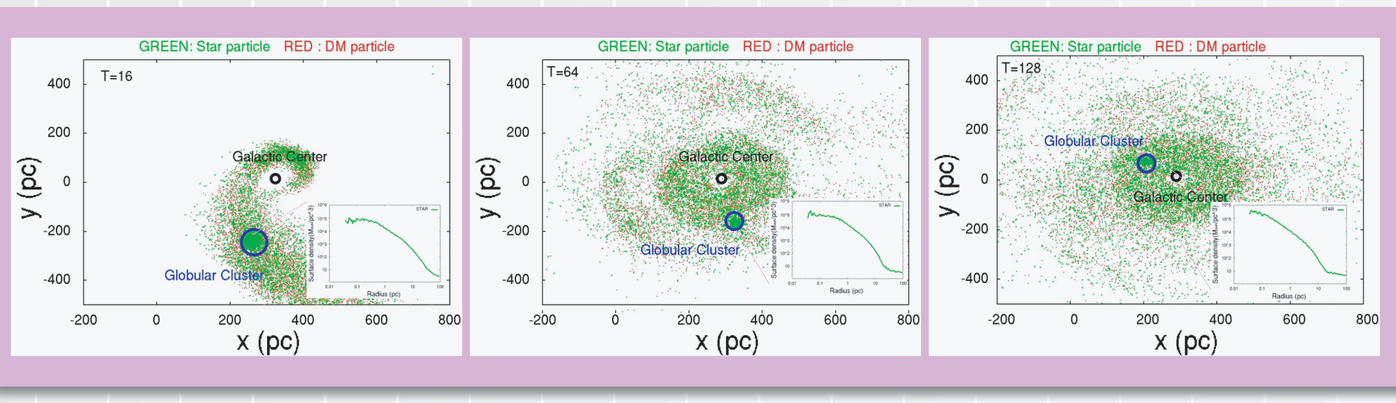




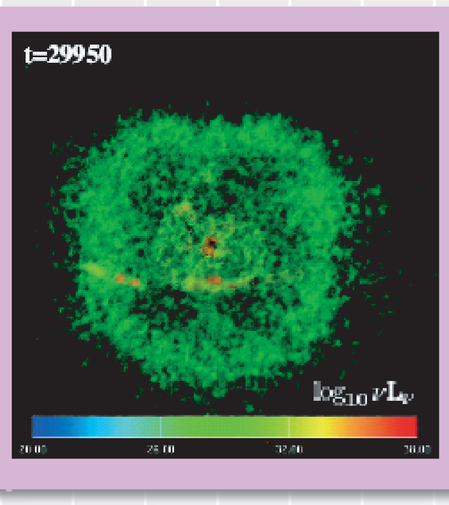
The star formation in first generation objects is regulated by ionizing and photodissociating radiation emitted from previously formed stars. Such regulation has been explored by radiation hydrodynamics (RHD) with accurate treatment of radiation transfer. An RHD simulation with the *FIRST* simulator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

Formation of globular clusters

FIRST simulator allows us to simulate the dynamical evolution of a globular cluster, where the two-body gravitational encounter plays an important role in the dynamics. Using the *FIRST* simulator, *N*-body simulations are performed to solve the dynamical evolution of a globular cluster in a galactic tidal field. The simulations have been done with high accuracy to trace orbits of each star to simulate two-body relaxation.



Radiative magnetohydrodynamic accretion flows in the galactic center



The behavior of photons in magneto-hydrodynamic (MHD) accretion flows plunging into a supermassive black hole in our galactic center is investigated by using 3-D radiation transfer (RT) simulations. The simulations with the *FIRST* simulator have revealed rapid variation in the spatial distribution of the emergent photons that can account for variable emissions in recent observations.