Center for Computational Sciences, University of Tsukuba
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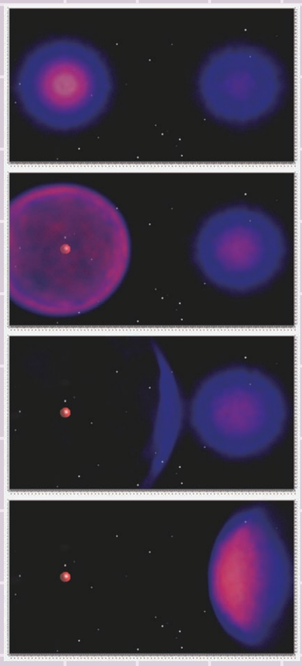
FIRST
The Origin of FIRST Generation Objects

Deciphering the History of the Universe

Illumination from the First Star

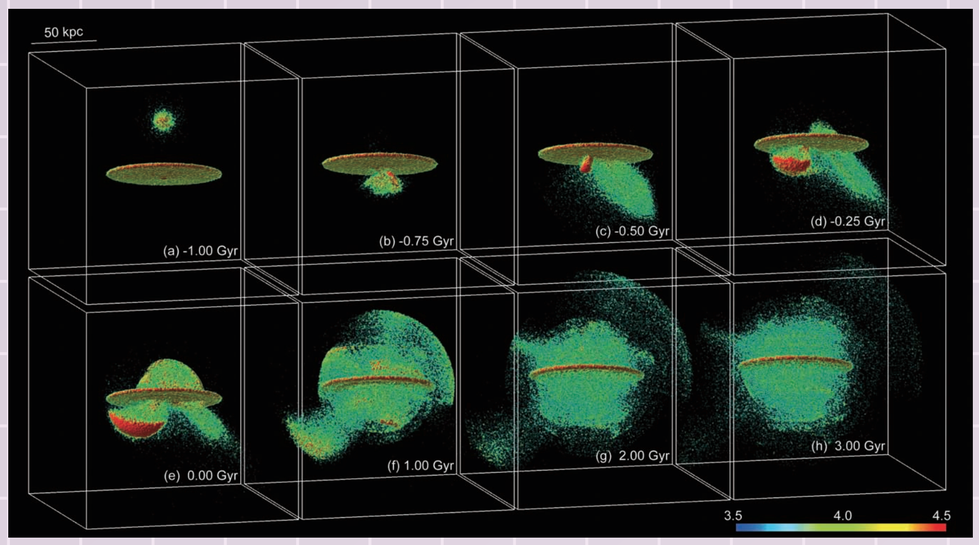


We have modeled the radiative feedback by a pre-formed first star using a state-of-the-art three-dimensional radiation hydrodynamic simulation. In this simulation, we found that Ultra violet radiation emitted from the first star severely suppresses subsequent star formation around the first star.

We simulated the transfer of Ultra violet radiation from the first star (left star). The radiation subsequently ionizes and heats the surrounding gas and prevents the formation of the dense core (right) of gas that could be a star in the absence of the left star.

Evolution of Galaxies through Merging

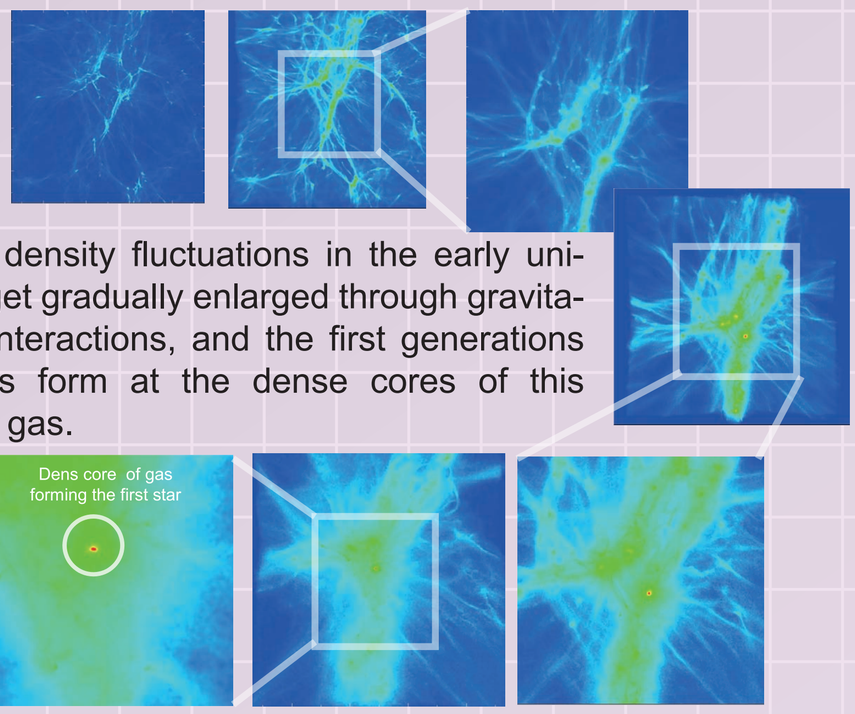
Present-day galaxies are built up through the successive merging of smaller galaxies. Numerical simulations of such galaxy merging help us to understand how galaxies have evolved to what we see today in the universe.



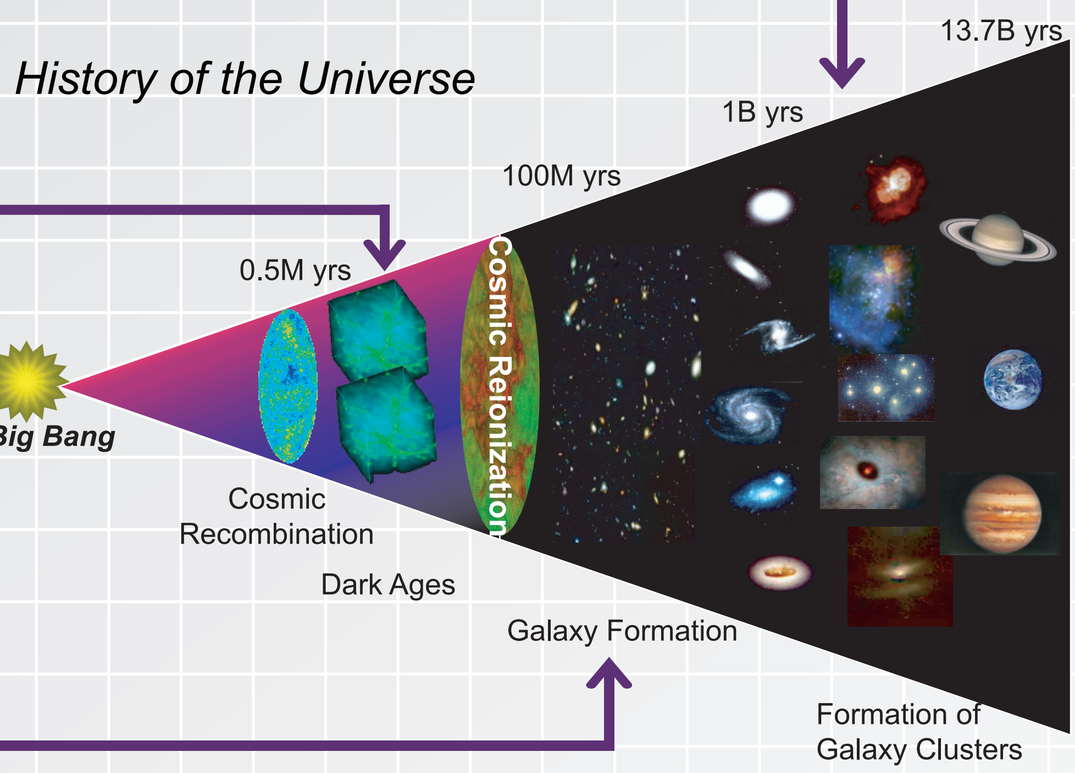
Numerical Simulation of a Merging Between Andromeda and a Dwarf Galaxy

The First Star in the Universe

What was the first star in the universe like? So far, no astronomers have observed it. Based on the state-of-the-art numerical simulation, we investigate the formation of the first generations of stars, and their influences on the subsequent evolution of the universe.



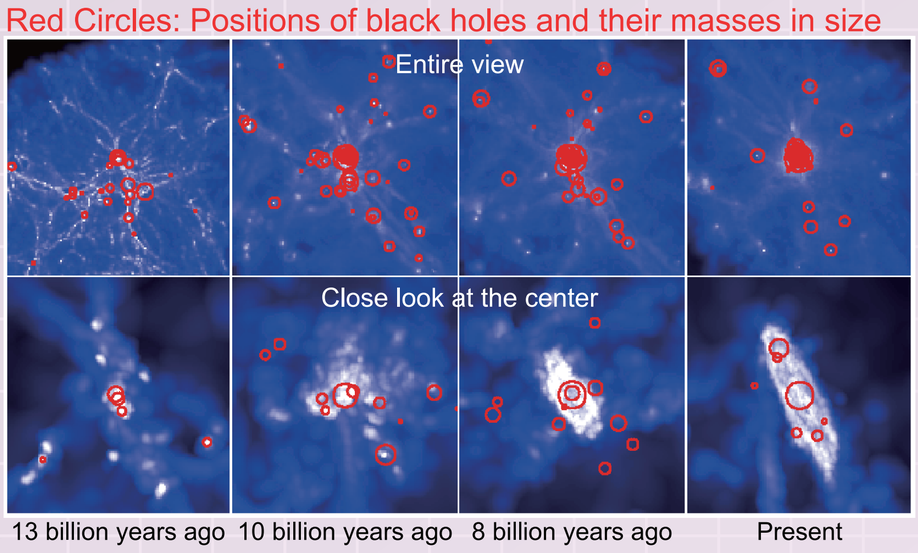
Tiny density fluctuations in the early universe get gradually enlarged through gravitational interactions, and the first generations of stars form at the dense cores of this cosmic gas.



Formation of Spiral Galaxies and Super-Massive Black Holes

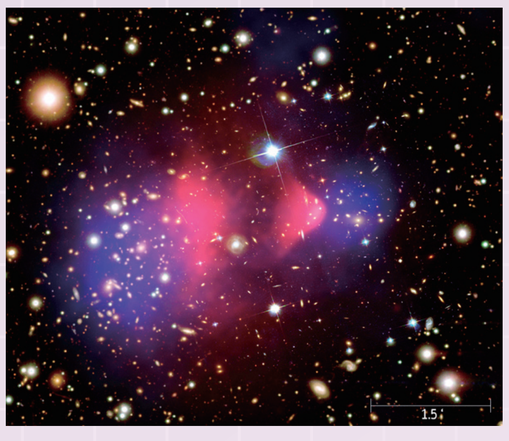
It turns out that almost all galaxies host very massive black holes in their centers. We have shown that such super-massive black holes are cooperatively built through the formation of spiral galaxies.

Red Circles: Positions of black holes and their masses in size



Unveiling the identity of dark matter and cosmic plasma in merging galaxy clusters

Merging of galaxy clusters provides us with the opportunity to probe the physical properties of invisible dark matter and energetic cosmic plasma.



X-ray Image: NASA/CXC/CfA/M. Markevitch et al.; Optical Image: NASA/STScI; Magellan/U. Arizona/D. Clowe et al.; Gravitational Lensing: NASA/STScI; ESO WFI; Magellan/U. Arizona/D. Clowe et al.

Distribution of hot plasma (red) and dark matter (blue) inside the merging galaxy cluster, 1E0657-56