Center for Computational Sciences, University of Tsukuba
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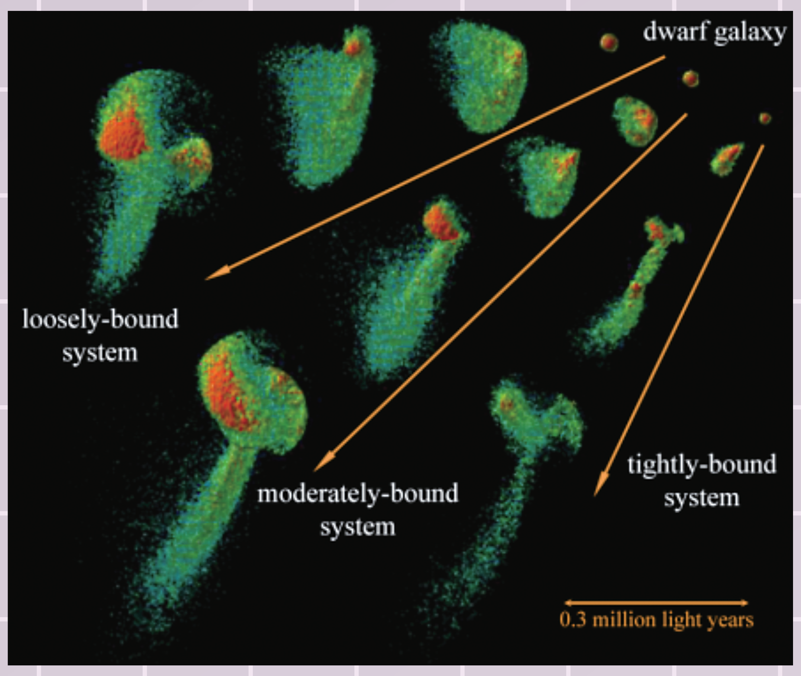
JICFuS

HPC in Astrophysics

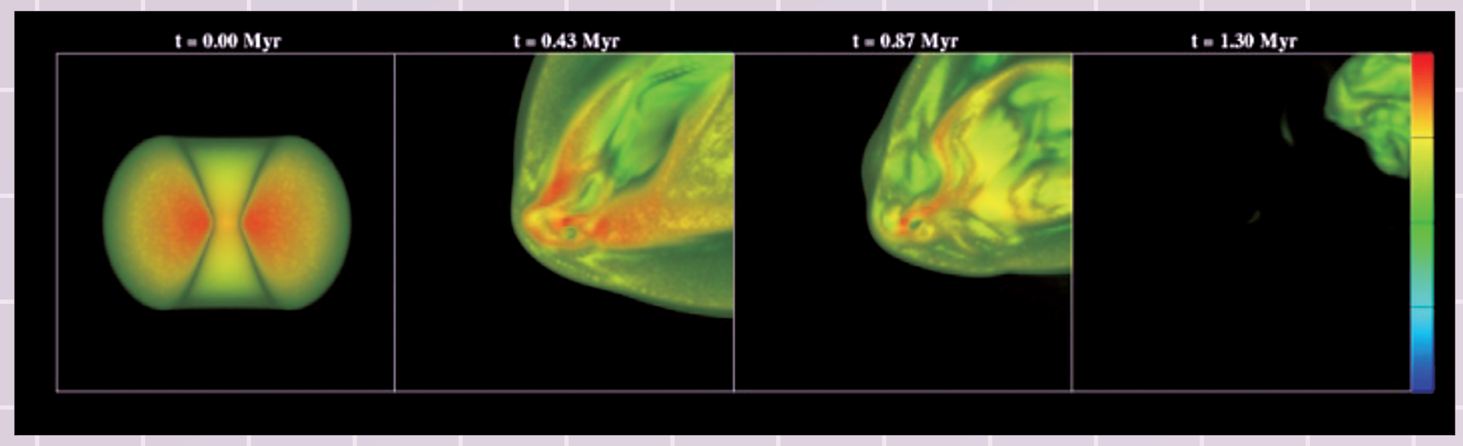
Galaxy Collision



N-body simulations of the interaction between an accreting small galaxy and the Andromeda galaxy.

Large galaxies such as the Andromeda galaxy are believed to have formed in part from the merger of many less massive galaxies. Here, we have studied the interaction between an accreting small galaxy and the Andromeda galaxy using N-body simulations. Each track along an arrow corresponds to the evolution of the projected stellar mass density of the merging small galaxies with the different binding energy.

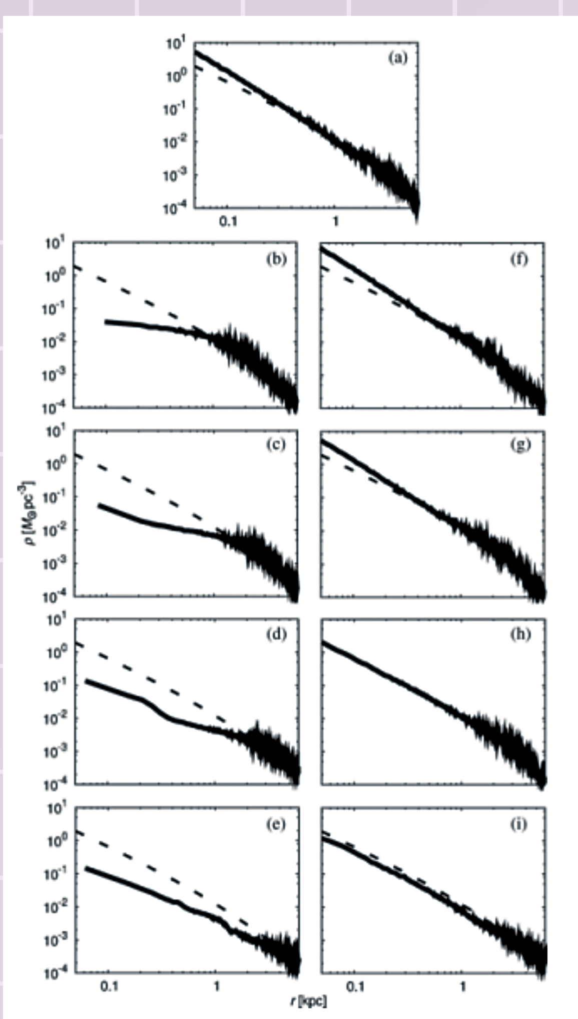
Death of Active Galactic Nuclei



Evolution of the gas density surrounding the massive black hole at the galaxy center.

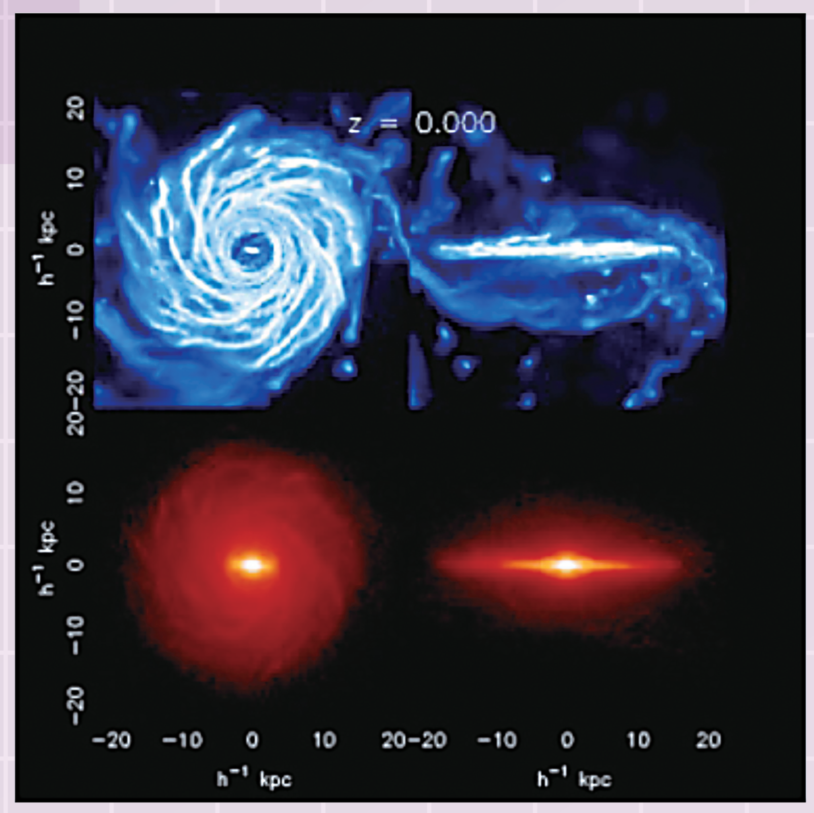
Active galactic nuclei are powered by gas accretion onto supermassive black holes at the center of each galaxy. Our simulation shows that the head-on collision of galaxies removes a significant amount of the gas surrounding the supermassive black hole and chokes the life out of the active galactic nuclei.

The Core-Cusp Problem in Cold Dark Matter Halos and Supernova Feedback: Effects of Mass Loss



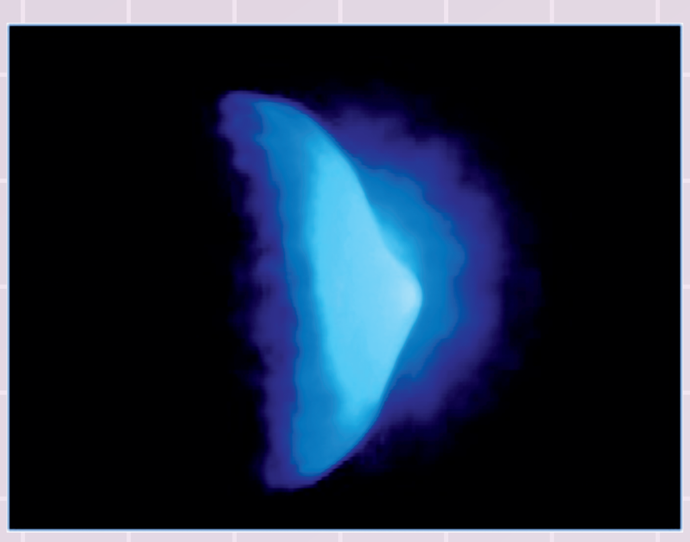
Evolution of the density profiles of a dark matter halo for the instantaneous mass-loss model (left panels) and the adiabatic mass-loss model (right panels). The top panel (a) shows the density profile of the quasi-equilibrium state after adding the external potential on the initial Fukushige-Makino-Moore model. The other panels show the density profiles of a dark matter halo at 15 td (b and f), 30 td (c and g), 50 td (d and h), and 110 td (e and i), respectively. The dashed line represents the Fukushige-Makino-Moore initial condition.

Galaxy Formation



A realistic Milky Way-like galaxy formed in a supercomputer. Upper panels show the gas distribution in the simulated galaxy and the lower ones display the projected stellar density. The viewing angles are to be face-on and edge-on for the left and right panels, respectively.

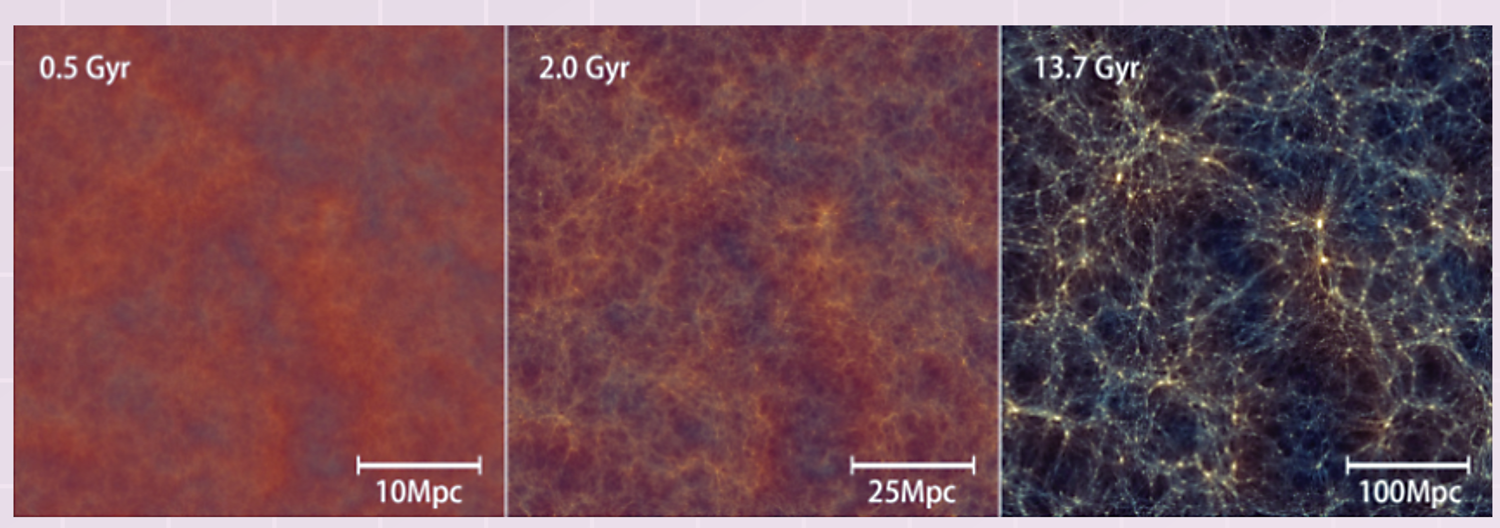
Merger of Galaxy Clusters



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

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

Large-Scale Structure of the Universe



We can follow the evolution of small initial density fluctuations of the universe by high resolution cosmological N-body simulations. The structure of our universe is hierarchical. Galaxy clusters are composed of many galaxies. Clusters and galaxies form large scale structures. Such structures are considered to be created by the growth of small initial density fluctuations by gravity over ten billion years.