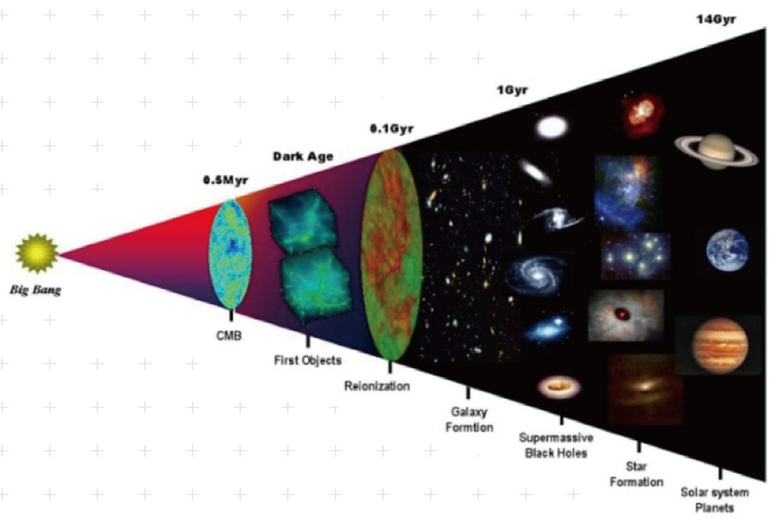
FIRST Project

The simulator *FIRST* was constructed under the collaboration between astrophysicists and computer scientists to explore the structure formation in the universe. The project is funded by a Specially Promoted Research in Grants-in-Aid for Scientific Research with the budget of JPY428 million (US$5.5 million), approved by MEXT in Japan. *FIRST* is a new type of hybrid computer, in which a newly-developed board for gravity calculations, Blade-GRAPE X64, is embedded in each node.

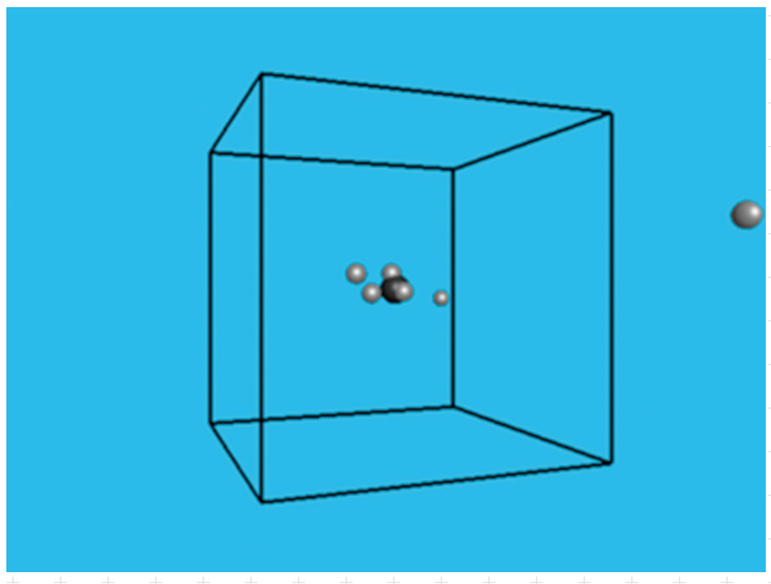


History of the Universe

***FIRST* simulator (256 nodes, 36.1TFLOPS) and Blade-GRAPE board.**

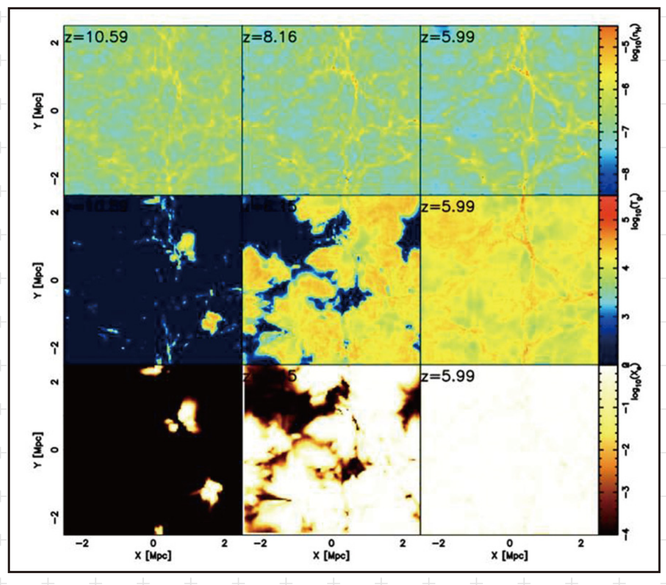
Astrophysical Simulations

Successive Merger of Multiple Massive Black Holes in a Primordial Galaxy

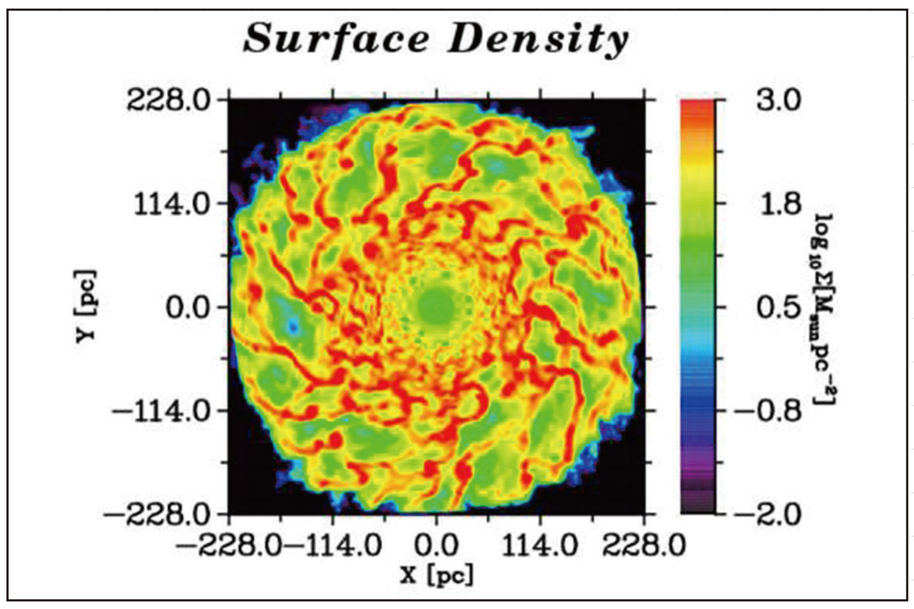


Using *FIRST*, the evolution of multiple massive black holes (MBHs) is pursued in a primordial galaxy that is composed of dark matter, stars, and ten MBHs. It is found that five MBHs merge successively, emitting gravitational radiation. These simulation results show that multiple MBHs can produce a heavier BH in the galactic center purely through N-body process.

Radiation Hydrodynamic Simulation on Cosmic Reionization



This figure represents maps of physical quantities at redshifts z=10.59, 8.16, and 5.99 from left to right. Evolution of number density, temperature, and ionization degree is shown in the upper, middle, and lower rows, respectively.



Formation of molecular gas filaments in a MHD simulation of Central Molecular Zone

This figure shows the gaseous surface density seen from the north Galactic pole. The molecular gas filaments are formed by the self-gravitational instability. These filaments exchange their angular momentum each other via gravitational force. This angular momentum transfer results in gas accumulation around R=100 pc.