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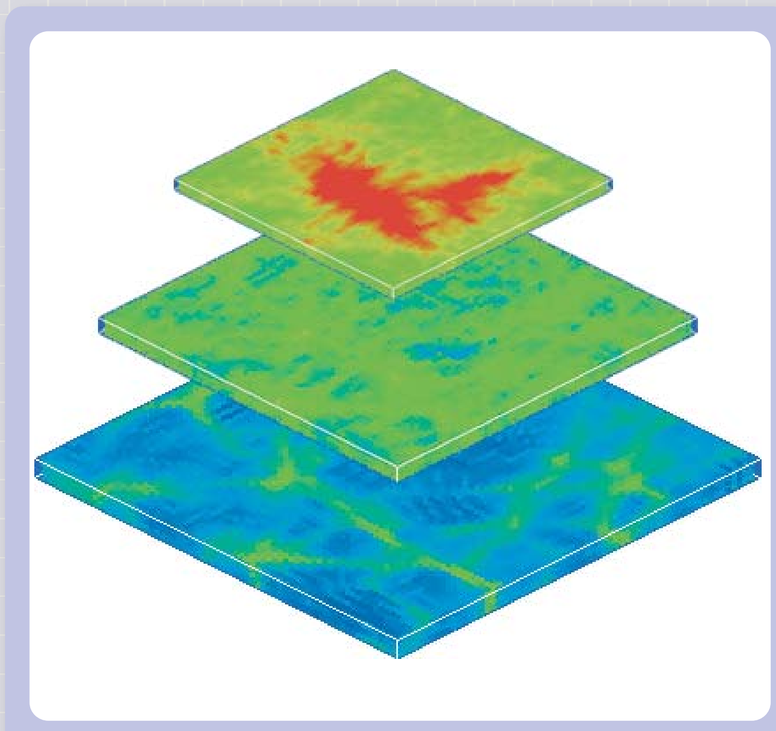
History of the Universe explored by Radiation Hydrodynamics

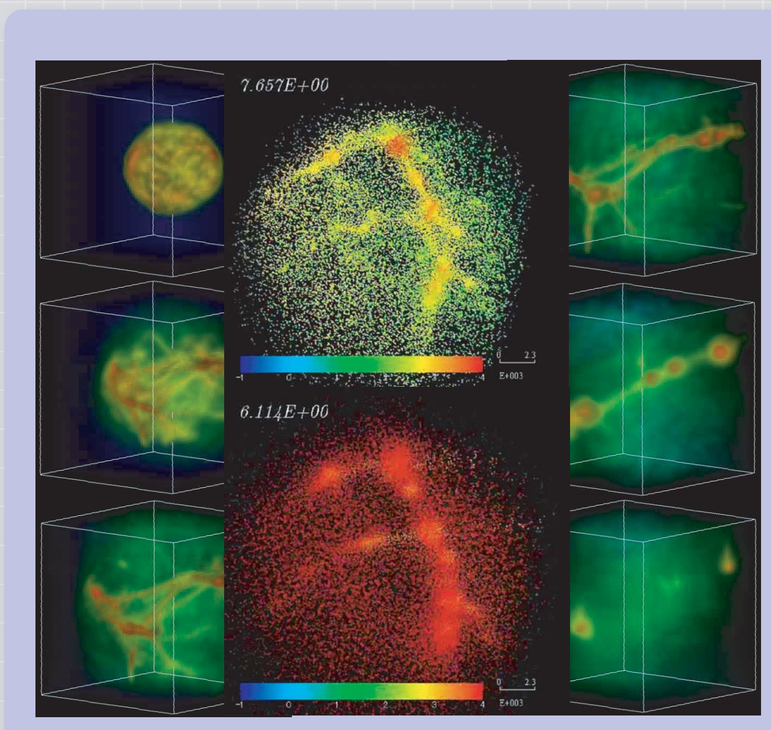
Reionization of the Universe

The recent observation of the cosmic microwave background by the WMAP (Wilkinson Microwave Anisotropy Probe) has revealed that the universe was reionized at as early as redshift z=17. We have simulated this early reionization of the universe with CP-PACS by solving the radiative transfer in an 3D inhomogeneous universe. As a result, it is found that to satisfy the WMAP results the ultraviolet background intensity at z>14 is required to be on the same level as the intensity at z=4. This implies that a lot of ionizing sources were born in the early universe of z>14.



3D radiative transfer calculation
on the cosmic reionization by CP-PACS

Simulation of Galaxy Formation by HMCS



3D RHD simulation on the galaxy formation
by HMCS（CP-PACS+GRAPE).

The formation of dwarf galaxies during the cosmic reionization has been explored with HMCS. We have solved the hydrodynamics as well as the radiative transfer of ionizing photons. In this simulation, the following mechanism has been revealed. First, baryonic gas falls into dark matter potential to form filamentary structures. After the universe is reionized, metagalactic ultraviolet irradiates the filamentary clouds. The bulk of gas is evaporated due to heating by ultraviolet radiation. But, the self-shielded core can collapse to form small galaxies even in ultraviolet radiation.