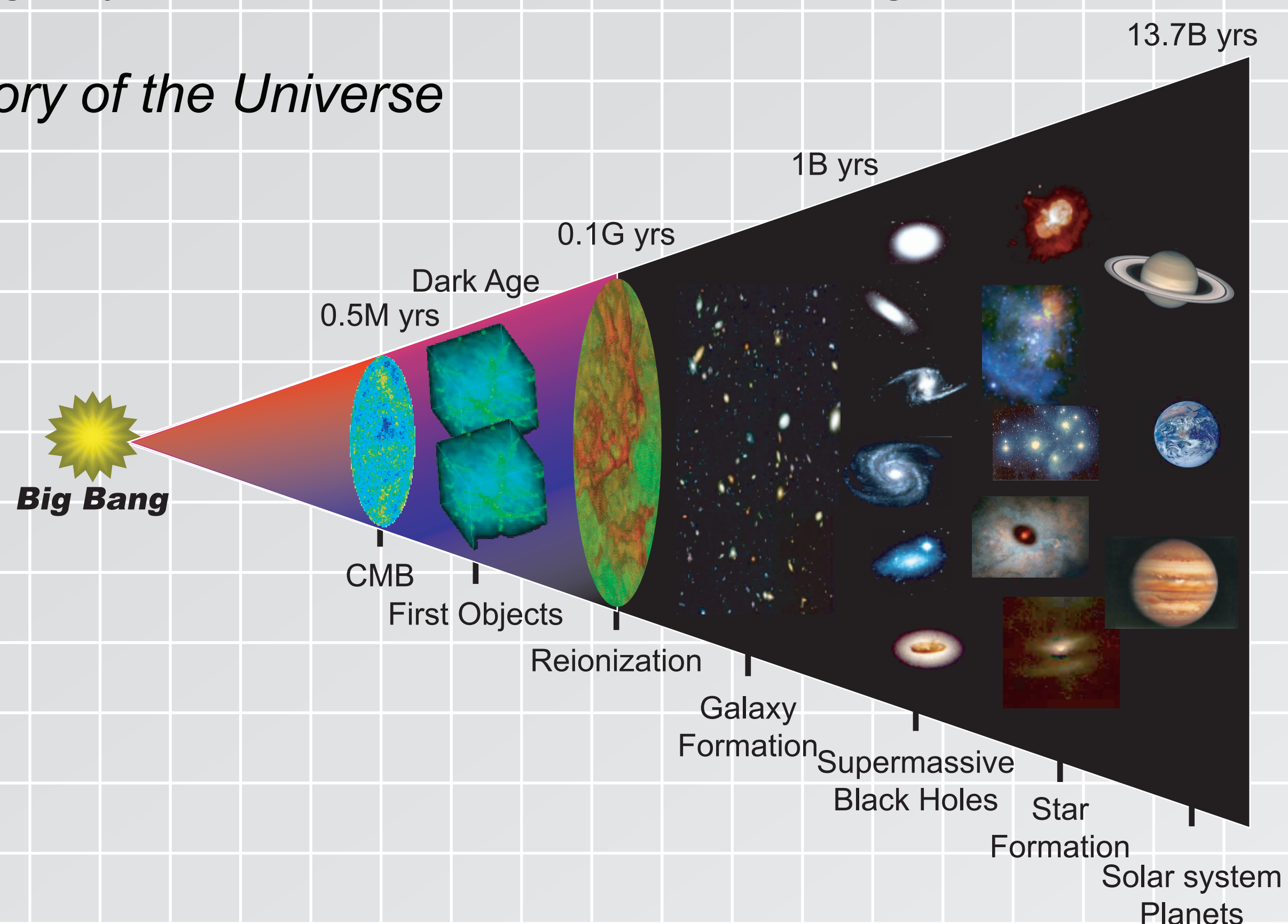**FIRST**
The Origin of FIRST Generation Objects

Computational Astrophysics

In the computational astrophysics group, we are exploring the structure formation in the universe, concentrating on the coupling effects of radiation and matter. We have performed a wide variety of simulations on the cosmic structure, using a hybrid cosmo-simulator *FIRST* and a large-scale PC cluster *T2K-Tsukuba*.

History of the Universe

FIRST Project

FIRST simulator (256 nodes, 36.1TFLOPS)

The simulator *FIRST* was constructed under the collaboration between astrophysicists and computer scientists. The project is funded by a Specially Promoted Research in Grants-in-Aid for Scientific Research since 2004 with the budget of JPY428 million (US$4.7 million), approved by MEXT in Japan. *FIRST* is a new type of hybrid computer dedicated for astrophysical simulations.
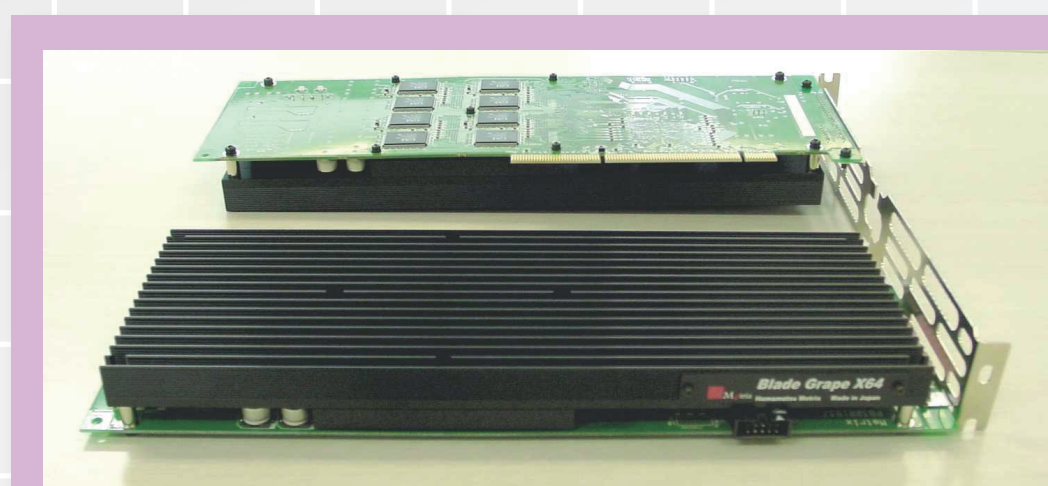
Blade-GRAPE X64
(136.8GFLOPS)

The *FIRST* is a hybrid PC cluster, where a newly-developed board for gravity calculations, Blade-GRAPE X64, is embedded in each node through PCI-X bus. The theoretical peak performance of Blade-GRAPE is 136.8GFLOPS. Each board has 16MB memory and can calculate the self-gravity of 260,000 particles simultaneously. Using Blade-GRAPEs, we have constructed a 256 node hybrid PC cluster system, that is, *FIRST* simulator. The host PC cluster node is a 2U-size of server PC (HP ProLiant DL380 G4) that has dual Xeon processors. The peak performance of *FIRST* simulator is 36.1TFLOPS, where the host PC cluster is 3.1 TFLOPS and the Blade-GRAPEs are 33 TFLOPS. All nodes are connected uniformly with each other via multi-port Gbit ether interconnect switch. The total memory of *FIRST* simulator is 1.6TB. Also, the *Gfarm* Grid file system, which is the commodity-based distributed file system that federates local disk of each node, is installed. With *Gfarm*, the storage of 89.2TB is available as a seamless file server.

The Blade-GRAPE boards were manufactured by Hamamatsu Metrics Co. and the 2Uservers were procured from Nihon Hewlett-Packard Co. Also, Best-Systems Inc. and Sumi-Sho Computer Systems Co. are joined in the development of the system.