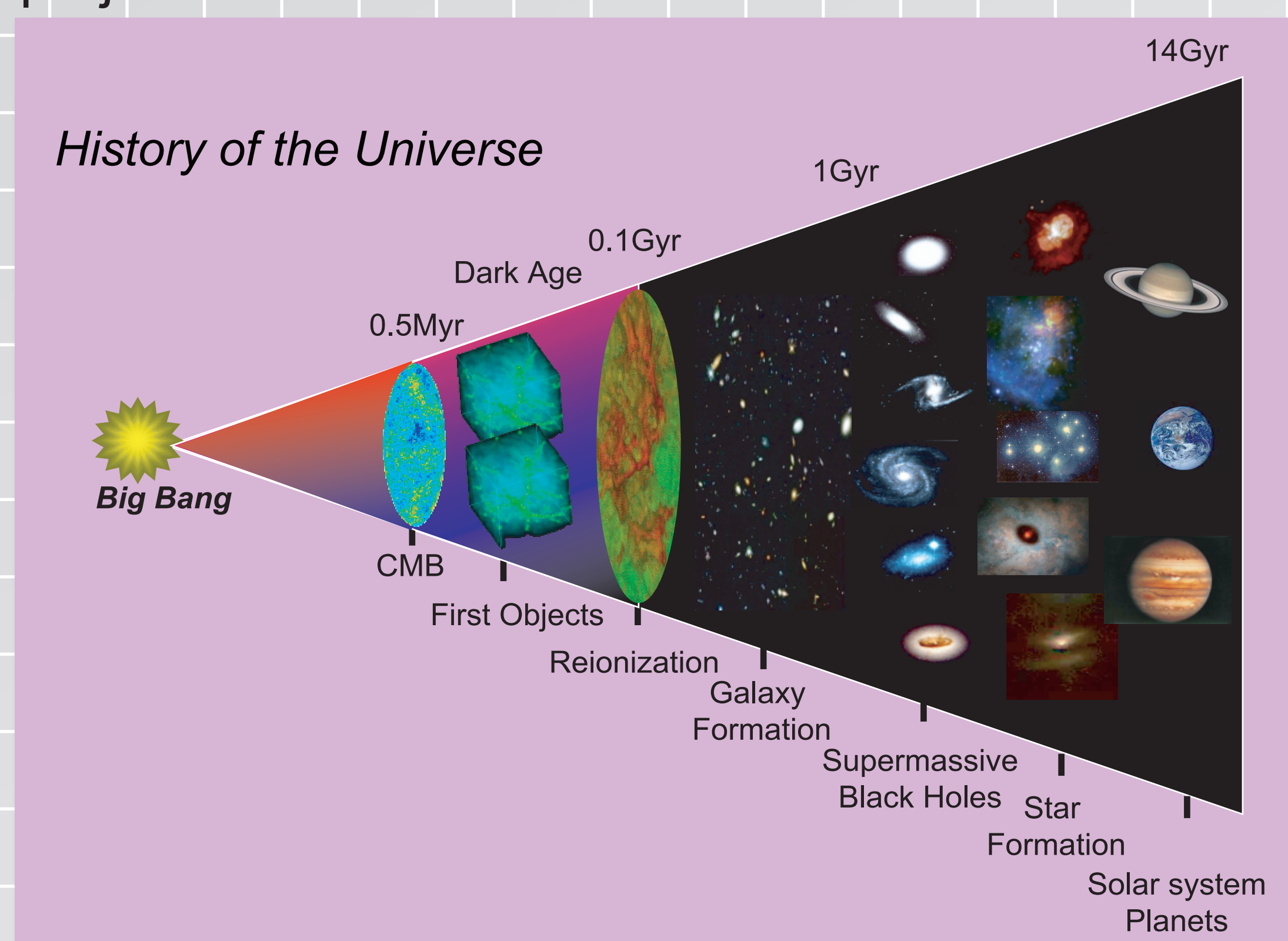*FIRST*
The Origin of FIRST Generation Objects

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. For the purpose, we have propelled an intensive project *FIRST*.

History of the Universe

14Gyr
1Gyr
0.1Gyr
Dark Age
0.5Myr
Big Bang
CMB
First Objects
Reionization
Galaxy Formation
Supermassive Black Holes
Star Formation
Solar system Planets

FIRST Project

This project is the collaboration between astrophysicists and computer scientists, exploring the origin of structure in the universe. 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$4.3 million), approved by MEXT in Japan. Under this project, we have developed a new type of hybrid computer dedicated for astrophysical simulations, called *FIRST* simulator.

FIRST simulator (256 nodes, 36.1TFLOPS)

Blade-GRAPE X64 (136.8GFLOPS)

The *FIRST* simulator 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 in a PC cluster. The theoretical peak performance of Blade-GRAPE is 136.8 GFLOPS. Each board has 16 MB memory and can calculate the self-gravity of 260,000 particles simultaneously at the maximum. 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 19-inch rack mountable server PC (HP ProLiant DL380 G4) that has dual Xeon processors in SMP configuration. The peak performance of *FIRST* simulator is 36.1 TFLOPS, 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 Ethernet interconnect switch. The total memory of *FIRST* simulator is 1.6 TB. 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 22 TB is available as a seamless file server.

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