FIRST ⋆ *The Origin of FIRST Generation Objects*

FIRST Cluster

Hisory of Universe

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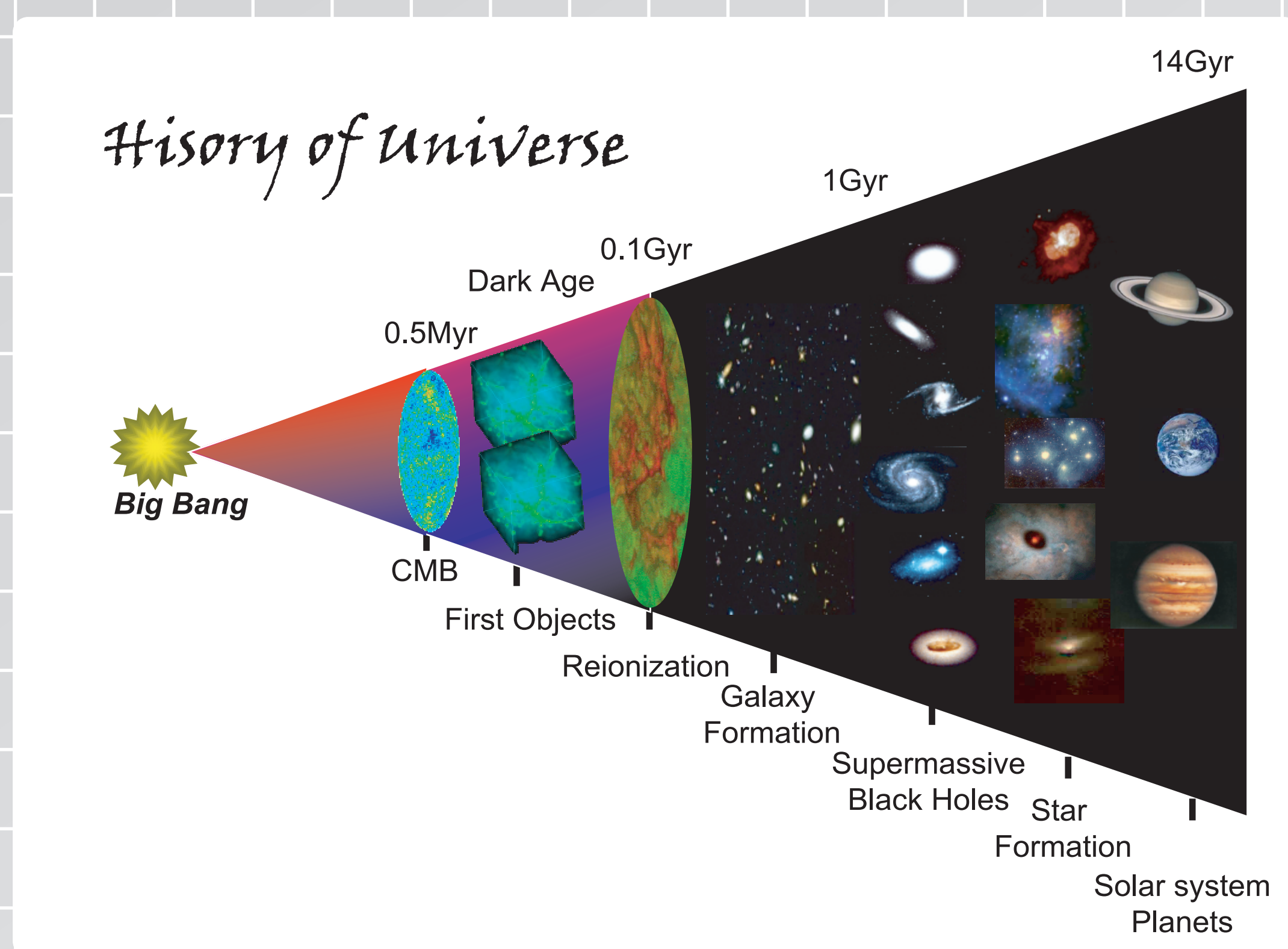Star Formation
Solar system Planets

Fig. 1 - The 240 node model of FIRST cluster (33.3TFLOPS).

The FIRST cluster is a heterogeneous PC cluster, which is dedicated to elucidating the formation of first generation objects in the universe. In this cluster, a newly-developed GRAvity PipE (GRAPE) processor, called Blade-GRAPE (Fig. 2), is embedded in each node. Fig. 1 shows the 240 node model of FIRST cluster. The theoretical peak speed of this system is 33.3TFLOPS (33TFLOPS in Blade-GRAPEs and 3TFLOPS in host nodes).

Node: 2U-server with Blade-GRAPE

A special GRAPE board for full size PCI slot, Blade-GRAPE (see Fig 2), is newly developed. It is embedded in a 2U-size of 19-inch rack mountable server PC which has dual CPUs in SMP configuration. The Blade-GRAPE is directly connected to the board via two PCI-X bus slots. The Blade-GRAPE's electric power supply is from the PCI-X bus (3.3V) as well as from the cluster server board, +12V (54W) and +5V(2.2W). The board's theoretical peak performance is 136.8GFLOPS. Each server PC is also equipped with multi-port Gigabit Ethernet NIC to be connected to a special interconnection network with commodity Ethernet switches.

The Blade-GRAPE boards were manufactured by Hamamatsu Metrics Co. and the 2Uservers were procured from Hewlett-Packard Japan, Ltd. Business Search Technology Co., Sumi-Sho Computer Systems Co., and Bestsystems Inc. also joined in the development of the system.

Fig. 2 - Blade-GRAPE board (136.8GFLOPS)