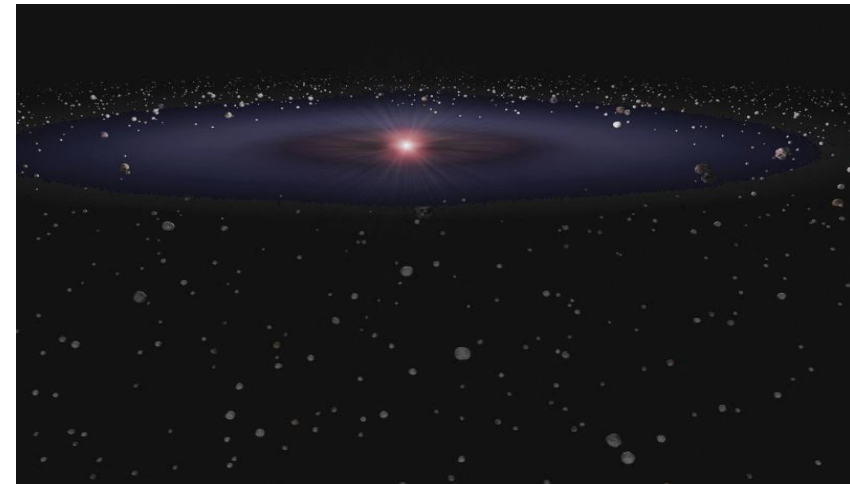


R&D field: Physics/astronomy

# Super large-scale gravitational many-body simulation for finding the celestial origin

- Program name: NINJA/ASURA
- Developer
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  - Keigo Nitadori, Ph. D student of The Univ. of Tokyo and collaborators
- Abstract
  - Calculation of development and formation of the galaxy caused by density fluctuation and gravity instability in early universe.
  - Calculation of formation of planets such as the earth caused by collision and merge of planetesimals.
- Algorithm
  - Combination of schemes such as the direct calculation, the tree method, SPH, and the independent time method.
  - Parallelization with the domain decomposition and the second-order schemes.
- Current computation size
  - Maximally 1 and 0.1 million particles for galaxy and planet formation, respectively.
- Future computation size in 2010
  - More than 100 and 1 million particles for galaxy and planet formation, respectively (required memory and disk are small because of the limitation on computation time).



Simulation of a planet-formation process (0.1 million year later after start of the simulation)

- Expected results
  - In simulation of galaxy formation, this program will bring innovation in understanding of galaxy formation because the program realizes simulation that can be compared directly with experiments based on decomposition of each star-formation domain (such decomposition has not been possible so far).
  - In simulation of planet formation, this program will identify the origin of variety of the planet systems by clarifying which physical quantities of primeval planet disks determine the basic properties of the planet systems such as planet type, mass, and orbit distribution.
- Reference
  - <http://xxx.lanl.gov/abs/astro-ph/0606105>