

**Simulations of the Formation, Evolution, and Clustering of Early Cosmic Structure**

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**【Outline of survey】**

Large ground-based telescopes have discovered distant astronomical objects such as galaxies and quasars that were in place when the Universe was less than 1 billion years old, corresponding to only about 5% of its current age. Moreover, these studies have shown that other luminous objects must have been present even earlier. Understanding how and when the first luminous objects were formed, and how they made the cosmic primordial gas to be in a plasma state is one of the major goals in modern cosmology and astronomy.

We study structure formation in the early universe using supercomputer simulations.

Our study will offer valuable inputs to future observations of the distant universe exploiting next-generation space-borne and ground-based telescopes.

**【Expected results】**

We use large three-dimensional cosmological simulations to reveal the following important properties of early cosmic structure.

1. The star-formation activities, gas metallicities of primeval galaxies
2. The evolution of chemical compositions in the inter-galactic medium
3. The effects of the nature of dark matter, dark energy, and models of inflaton field in the very early universe on the above properties.

The results are extensively used to make proposals for surveys of the young Universe.

**【References by the principal investigator】**

- N. Yoshida, K. Omukai, L. Hernquist, “Protostar Formation in the Early Universe”, Science in press (2008)
- N. Yoshida, S. Oh, T. Kitayama, L. Hernquist, “Early Cosmological HII/HeIII Regions and Their Impact on Second-Generation Star Formation”, Astrophysical Journal, 663, 687 (2007)
- V. Springel, S. White, C. Frenk, A. Jenkins, N. Yoshida et al. “Simulations of the formation, evolution and clustering of galaxies and quasars”, Nature, 435, 629

**【Term of project】** FY2008– 2012

**【Budget allocation】**

**49,300,000 yen** (direct cost)

**【Homepage address】** <http://www.a.phys.nagoya-u.ac.jp/~nyoshida/cosmo.html>