PDF versions of previous colloquia and more information can be found in “events” at http://gcosmo.bao.ac.cn/

国台学术报告 NAOC COLLOQUIUM

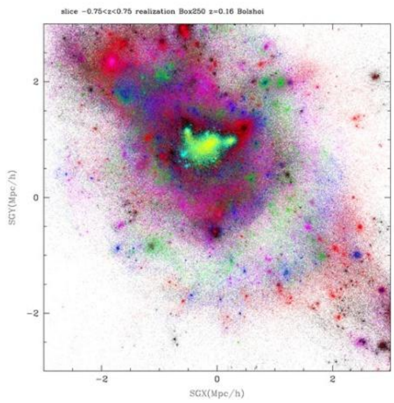
2012 年 第 48 次 / Number 48, 2012

TIME: Monday, 3:00 PM, Sep 10, 2012 **LOCATION: A601NAOC**

Λ CDM: Large-Scale Triumphs, Small-Scale Challenges, and the Latest Simulations

Prof. Joel Primack (UC Santa Cruz)

Joel R. Primack, a professor of physics at the University of California Santa Cruz, is one of the world's leading cosmologists and a creator of the foundational theory of Cold Dark Matter, which is the basis of the standard modern theory of the universe. He received his Ph.D. from Stanford in 1970. He was then a Junior Fellow of the Society of Fellows of Harvard University. After helping to create what is now called the “Standard Model” of particle physics, Primack began working in cosmology in the late 1970s and he became a leader in the new field of particle astrophysics. He is one of the principal originators and developers of the theory of Cold Dark Matter, which has become the basis for the standard modern picture of structure formation in the universe. He was made a Fellow of the American Physical Society (APS) in 1988 “for pioneering contributions to gauge theory and cosmology.” He was elected to the Executive Committee of the APS Division of Astrophysics 2001-2002. He has won awards for his research from the A. P. Sloan Foundation and the Alexander von Humboldt Foundation.



Abstract

Λ CDM has become the standard cosmological model because its predictions agree so well with observations of the cosmic microwave background and with the large-scale structure of the universe as shown by comparison of the latest cosmological simulations with observations. However ΛCDM has faced challenges on smaller scales. Some of these challenges, including the “angular momentum catastrophe" and the absence of density cusps in the centers of small galaxies, may be overcome with improvements in simulation resolution and feedback. Recent simulations appear to form realistic galaxies in agreement with observed scaling relations. Although dark matter halos start small and grow by accretion, the existence of a star-forming band of halo masses naturally explains why the most massive galaxies have the oldest stars, a phenomenon known as known as galactic “downsizing." The discovery of many faint galaxies in the Local Group is consistent with ΛCDM predictions, as is the increasing evidence for substructure in galaxy dark matter halos from gravitational lensing flux anomalies and gaps in cold stellar streams. The "too big to fail" (TBTF) problem, which challenges ΛCDM, arose from analyses of the Aquarius and Via Lactea very high resolution ΛCDM simulations of dark matter halos like that of the Milky Way. Each simulated halo at ~10 sub halos that were so massive and dense that they would appear to be too big to fail to form lots of stars. The TBTF problem is that none of the observed satellites of the Milky Way or Andromeda have stars moving as fast as would be expected in these densest sub halos. This may indicate the need for a more complex theory of dark matter -- but the latest simulations suggest that a better understanding of baryonic physics may resolve this problem.

All are welcome! Tea, coffee, biscuits will be served at 2:45 P.M.