How Did The First Stars and Galaxies Form? (**Mon. 3 – 5PM**, **Spring 2013**)

Syllabus

Course Instructor

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Course Requirements

Problem sets (due every week) and reading assignments from the required textbook

Required :

⋆ Loeb, A. 2010, *How Did the First Stars and Galaxies form?* (Princeton: Princeton U Press)

Recommended :

⋆ Schneider, P. 2006, *Extragalactic Astronomy and Cosmology* (Berlin: Springer)

Course Outline

⋆ *Reading assignments each week follows corresponding chapters in the required textbook.*

1. The Big Picture **1/28**

⋆⋆⋆ *Tour to the Great Refractor Telescope at the Harvard College Observatory* ⋆⋆⋆

In the Beginning

Observing the Story of Genesis

Practical Benefits from the Big Picture

2. Standard Cosmological Model **2/4**

Cosmic Perspective

Past and Future of Our Universe

Gravitational Instability

Geometry of Space

Cosmic Archeology Milestones in Cosmic Evolution

Most Matter is Dark

3. The First Gas Clouds **2/11, 2/25**

Growing the Seed Fluctuations

The Smallest Gas Condensations

Spherical Collapse and Halo Properties
Abundance of Dark Matter Halos
Cooling and Chemistry
Sheets, Filaments, and Only Then, Galaxies

4. The First Stars and Black Holes **3/4, 3/11**
Metal-Free Stars
Properties of the First Stars
The First Black Holes and Quasars
Gamma-Ray Bursts: The Brightest Explosions

5. The Reionization of Cosmic Hydrogen by the First Galaxies **3/25, 4/1**
Ionization Scars by the First Stars
Propagation of Ionization Fronts
Swiss Cheese Topology

6. Observing the First Galaxies **4/8**
Completing Our Photo Album of the Universe
Cosmic Time Machine
The Hubble Deep Field and its Follow-ups
Observing the First Gamma-Ray Bursts
Future Telescopes

7. Imaging the Diffuse Fog of Cosmic Hydrogen **4/15**
Hydrogen
The Lyman-α Line
The 21-cm Line
Observing Most of the Observable Volume

8. Future of the Universe **4/22**
End of Extragalactic Astronomy
Milky Way + Andromeda = Milkomeda

Special Lunch and Summary **4/29**