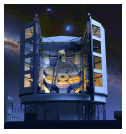
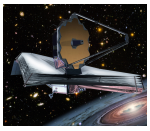


AST 353: Astrophysics

(Spring 2016)



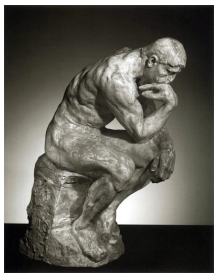
Birth, Life, and Death of the First Stars

Introduction

Prof. Volker Bromm
TA: Benny Tsang

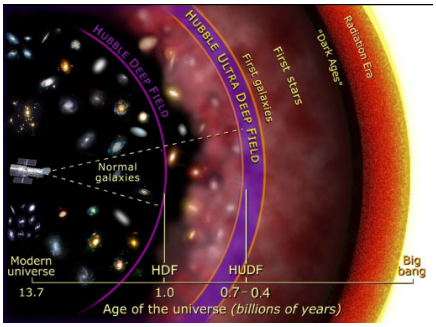
The University of Texas at Austin
Department of Astronomy

Astronomy: The Big Questions of Humanity



- What are our origins?
- What is our place in the universe

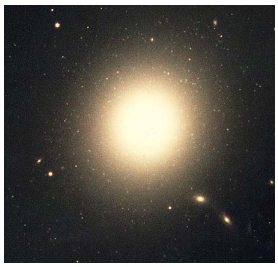
Cosmic Archaeology



- Looking out far into space enables us to see far back in time!

Galaxies through Time I: Nearby Universe

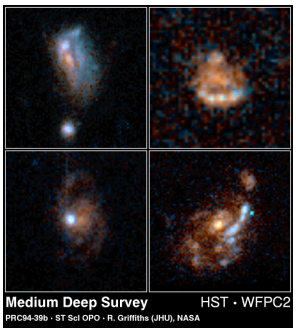
Andromeda (M31)



M87 (in Virgo cluster)

- Beautiful, well-developed galaxies!

Galaxies through Time II: Distant Universe



- Galaxies “under construction”!

Galaxies through Time II: Distant Universe

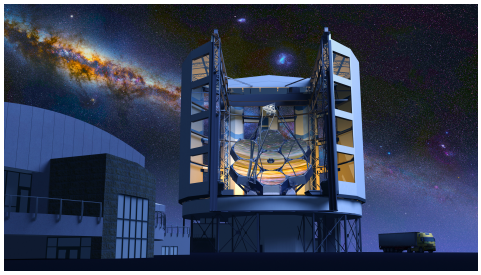
“With increasing distance, our knowledge fades, and fades rapidly. Eventually, we reach the dim boundary—the utmost limits of our telescopes. There, we measure shadows, and we search among ghostly errors of measurement for landmarks that are scarcely more substantial. The search will continue. Not until the empirical resources are exhausted, need we pass on to the dreamy realms of speculation.”
— Edwin Powell Hubble,
The Realm of the Nebulae (1936)

Galaxies through Time III: The First Galaxies

???

- The very frontier of knowledge!

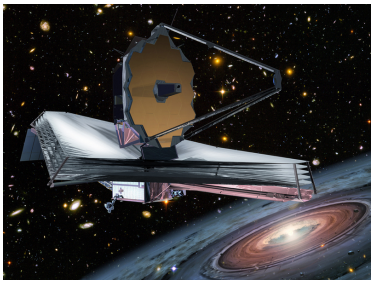
Next-generation Telescopes I



Giant Magellan Telescope (GMT)

- Giant (30-40m) telescopes on the ground

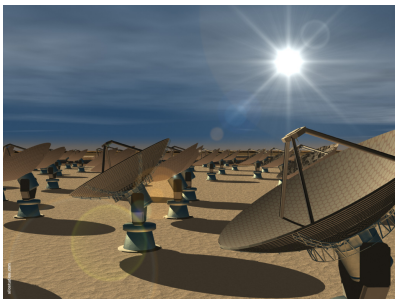
Next-generation Telescopes II



James Webb Space Telescope (JWST)

- To be launched ~2018 (successor to Hubble Telescope)

Next-generation Telescopes III



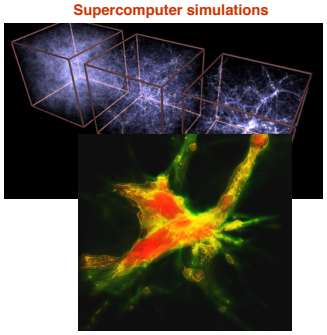
Square Kilometer Array (SKA)

- Giant radio telescopes (operational by ~2025)

Charting the Unknown: → Roadmap for Discovery

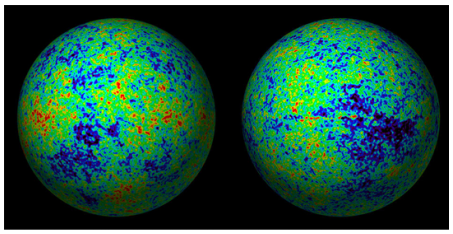
Laws of physics

Supercomputer simulations



Cosmic Microwave Background

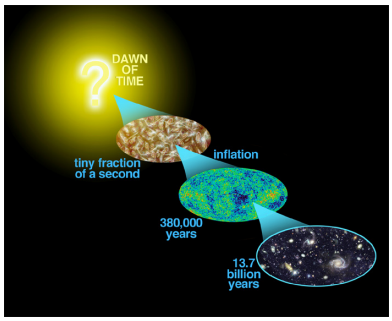
→ Picture of universe ~ million year after Big Bang



WMAP and *Planck* satellites

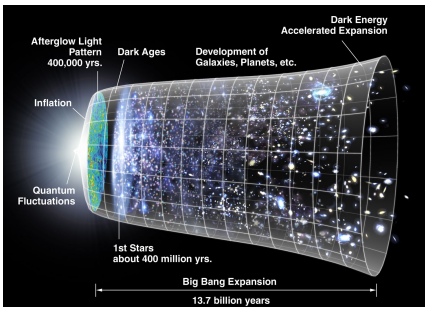
- Small fluctuations → seeds for galaxy formation

Cosmic Microwave Background



- Small fluctuations → seeds for galaxy formation

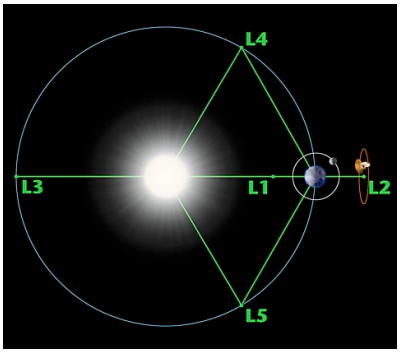
The History of the Universe



- First Stars → From Simplicity to Complexity

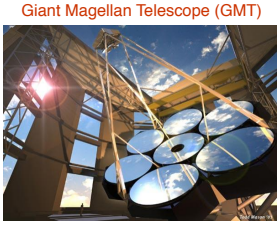
The James Webb Space Telescope (JWST)

The James Webb Space Telescope (JWST)

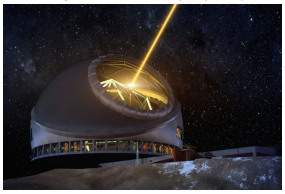


Future Ground-based Telescopes

Giant Magellan Telescope (GMT)



Thirty Meter Telescope (TMT)



- near-infrared, high-resolution observations
- Adaptive-optics enhanced

Perspectives:

- Very dynamic, rapidly developing field
- Closing the final gap in our worldview
- Driven by supercomputers and our best telescopes
- The high-redshift frontier: How did it all begin?
- UT Austin will play prominent role!