Hubble Probes the Early Universe

1990
Ground-based observatories

1995
Hubble Deep Field

2004
Hubble Ultra Deep Field

2010
Hubble Ultra Deep Field-IR

FUTURE
James Webb Space Telescope

Redshift ($z$):
- Time after the Big Bang:
  - Present: 6 billion years
  - 1 billion years
  - 1.5 billion years
  - 800 million years
  - 480 million years
  - 200 million years
  - >20 million years
Cosmic Epochs

- Galaxy A1689-zD1: ~700 million years after the Big Bang
- ~300,000 years: "Dark Ages" begin
- ~400 million years: Stars and nascent galaxies form
- ~1 billion years: Dark ages end
- ~4.5 billion years: Sun, Earth, and solar system have formed
- ~13.7 billion years: Present
Size of Hubble eXtreme Deep Field on the Sky