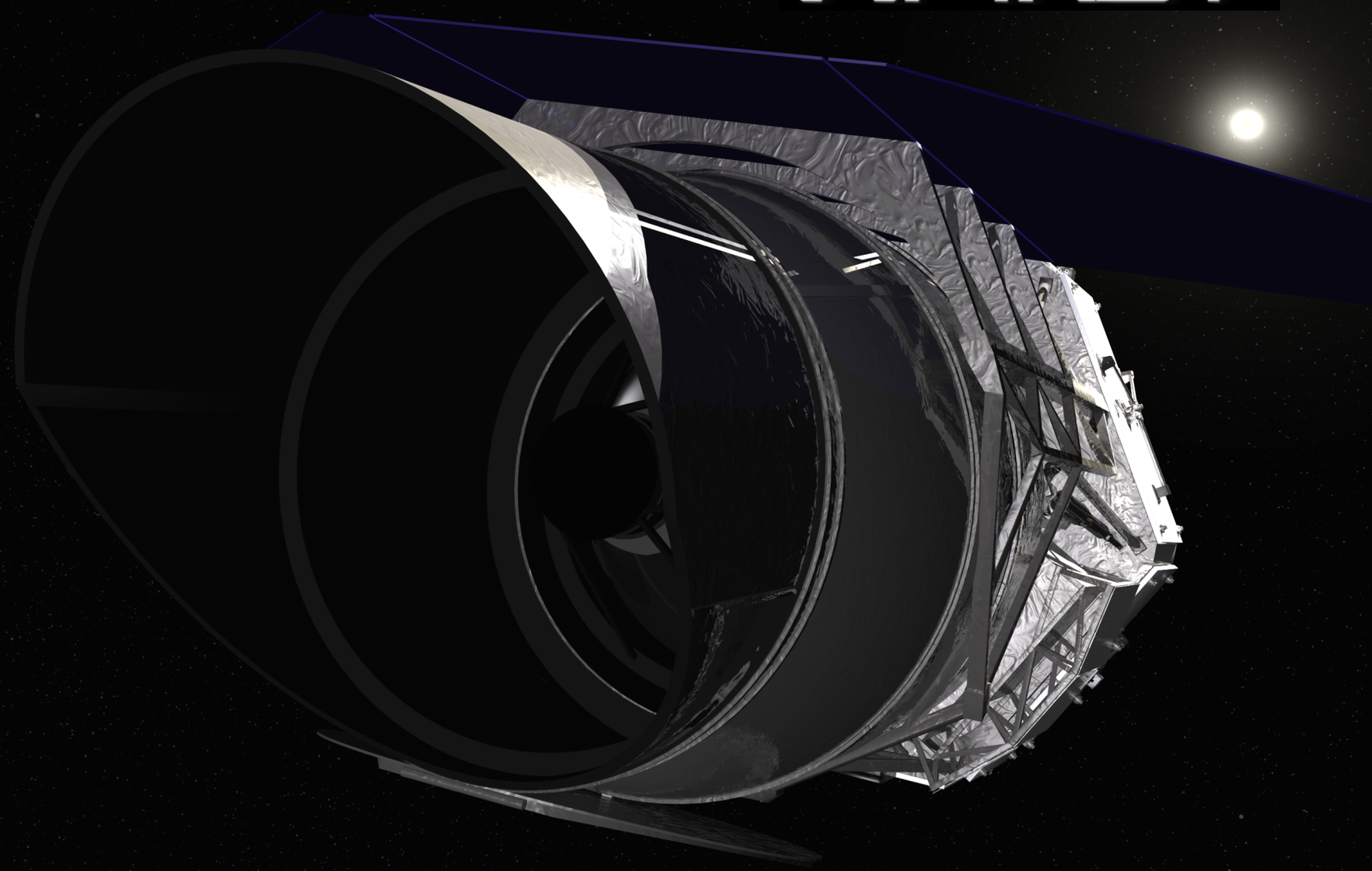
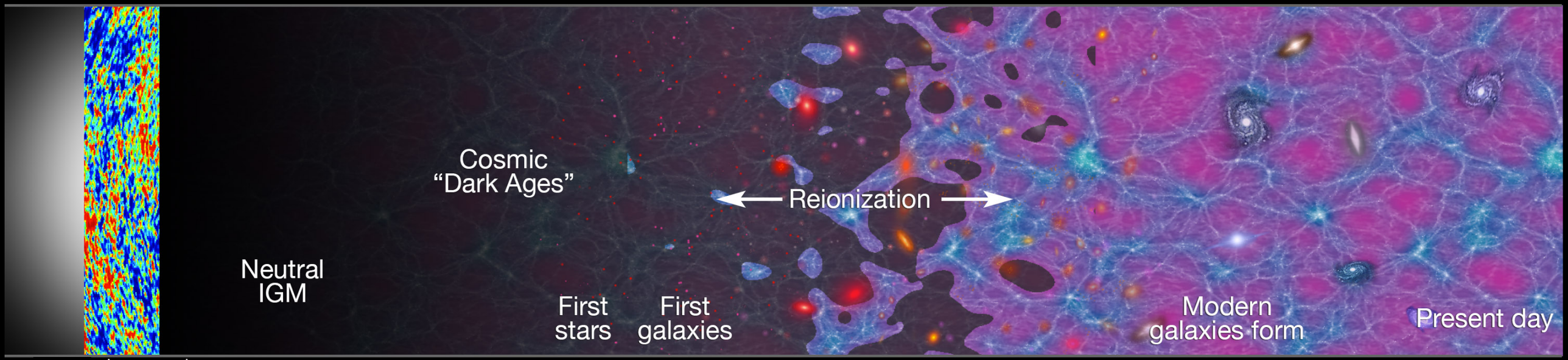
Discovering the Earliest Galaxies with WFIRST



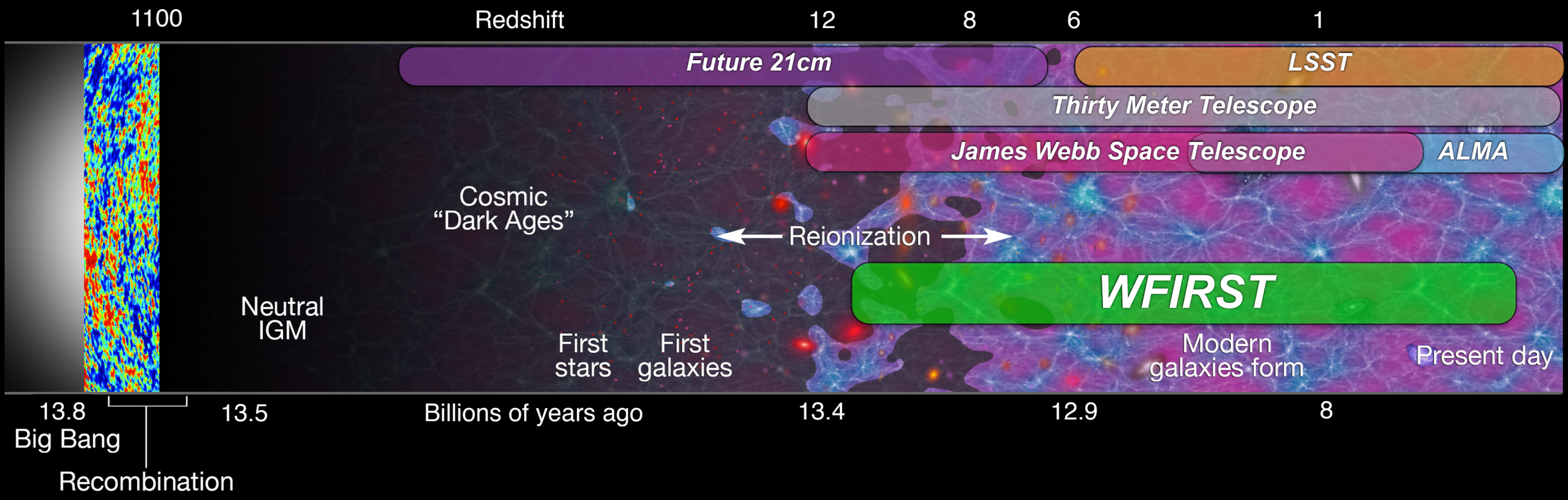
Jenny Greene
Princeton University

History of Galaxy Evolution over Cosmic Time



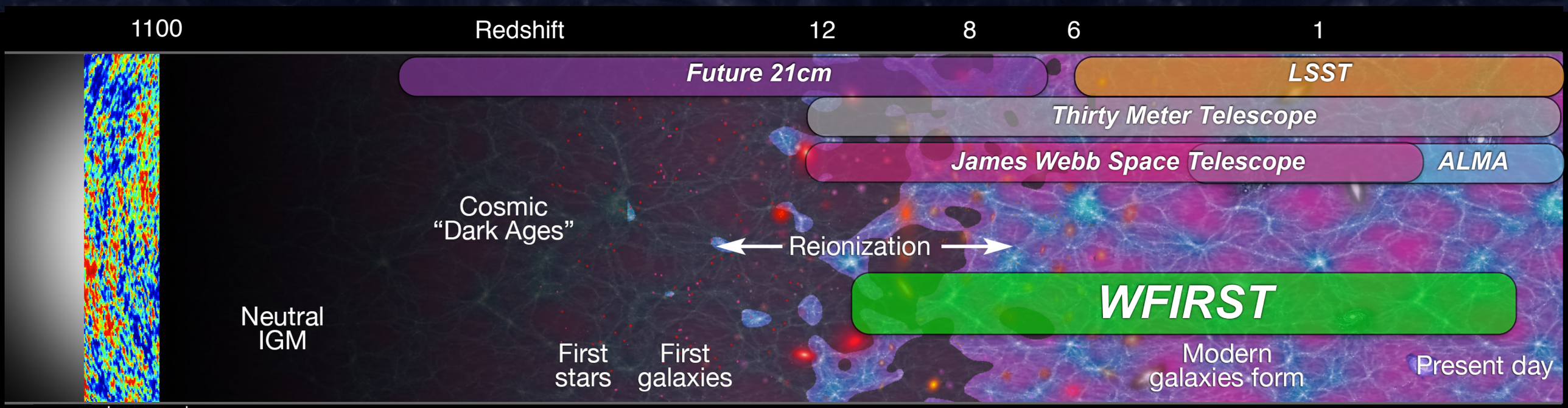
Adapted from Robertson et al. *Nature*, **468,** 49 (2010).

Astronomical Facilities in the Next Decade



Observations with ***WFIRST***, JWST, TMT/GMT/E-ELT, LSST, ALMA, and 21-cm experiments will drive astronomical discoveries over the next decade.

Adapted from Robertson et al. *Nature*, **468,** 49 (2010).



Important Questions for *WFIRST*

1.) How do cosmic environments influence galaxy evolution?

WFIRST will provide enormous samples of galaxies that probe all relevant ranges of cosmic density**.**

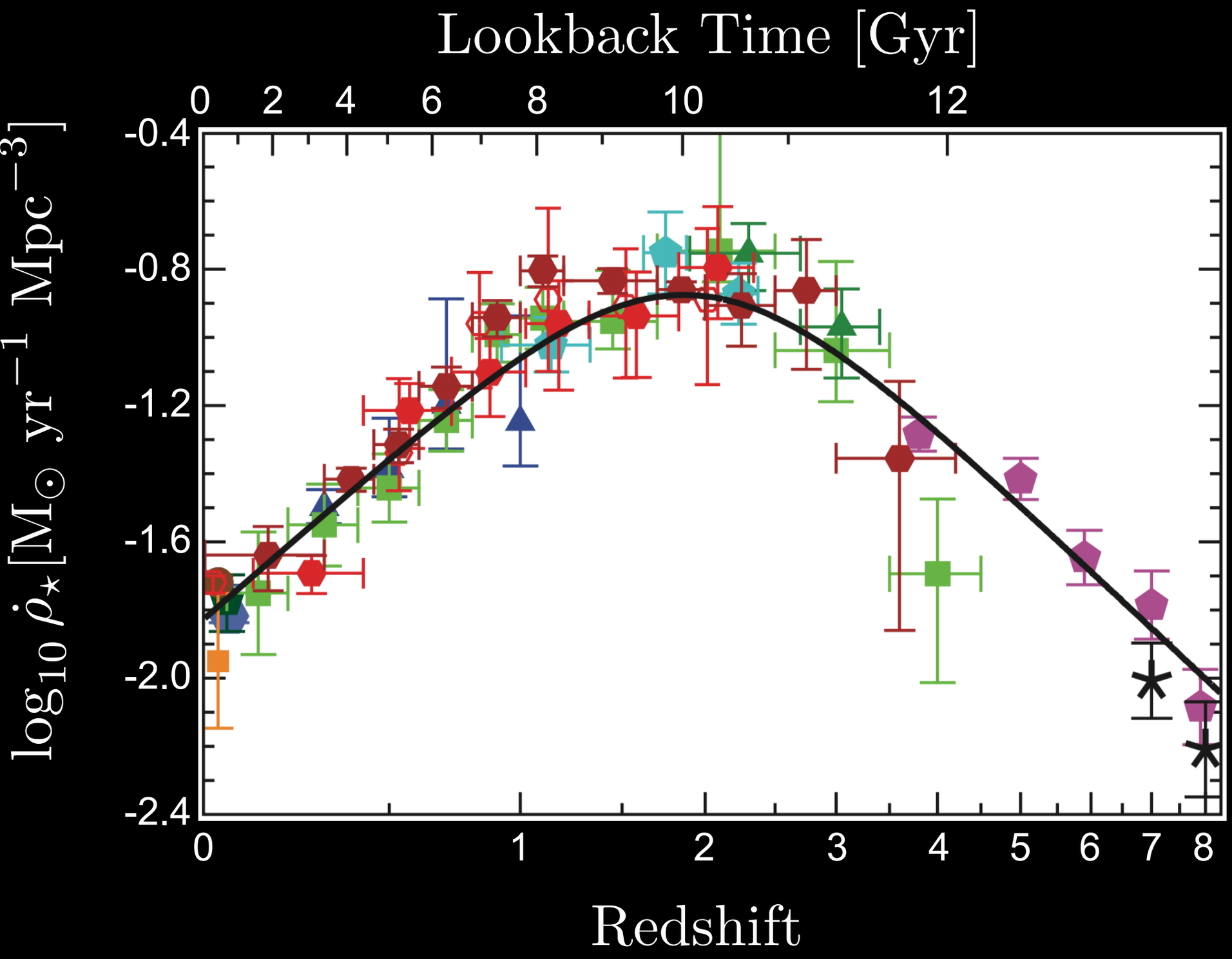
2.) What can rare objects tells us about galaxy formation?

WFIRST can discover the most luminous galaxies and the most massive black holes back to the first 500 million years of cosmic history.

3.) How do galaxies and quasars contribute to cosmic reionization?

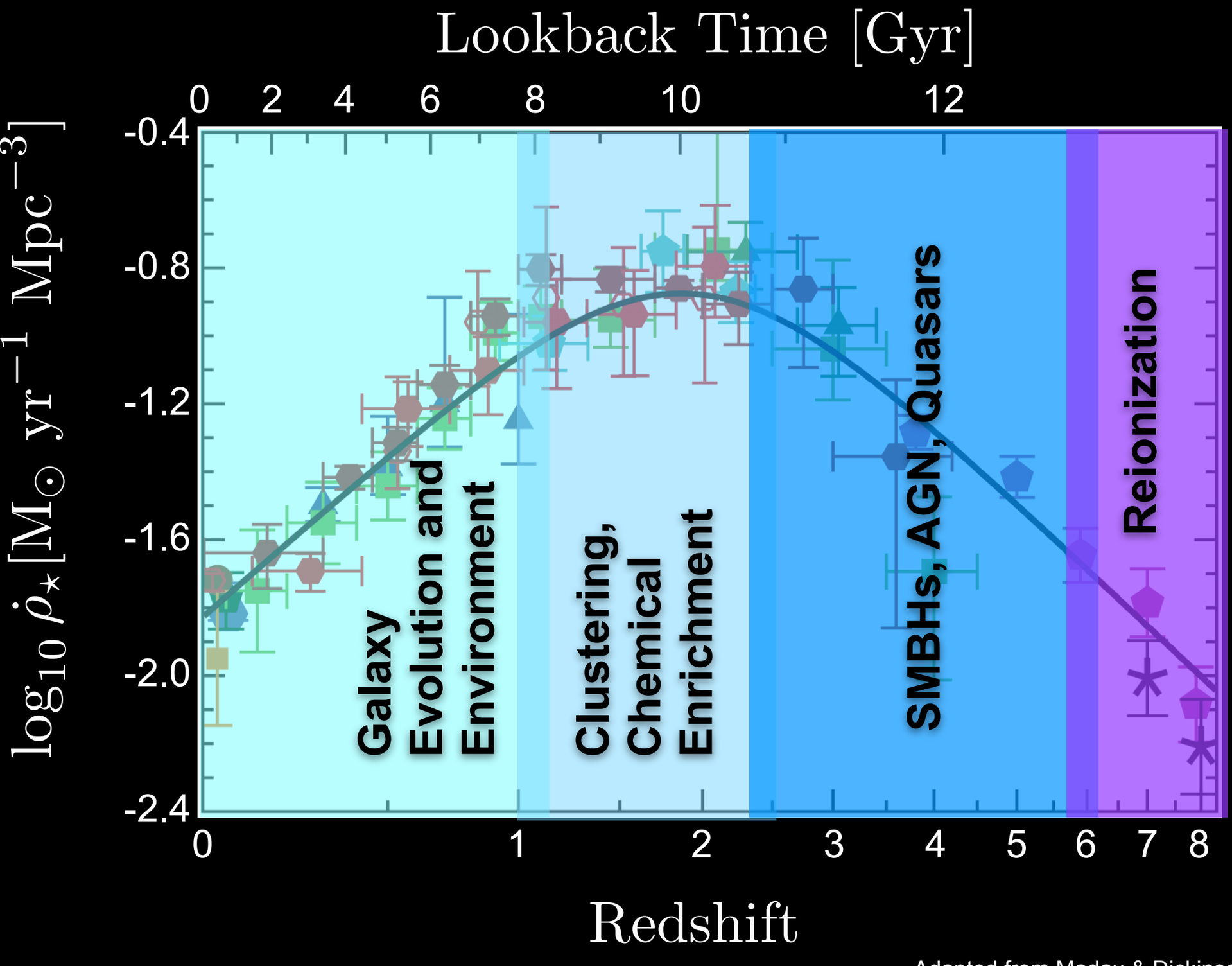
WFIRST can identify representative samples of galaxies and quasars during the reionization epoch, and quantify their relative importance for ionizing the intergalactic medium.

Cosmic Star Formation History



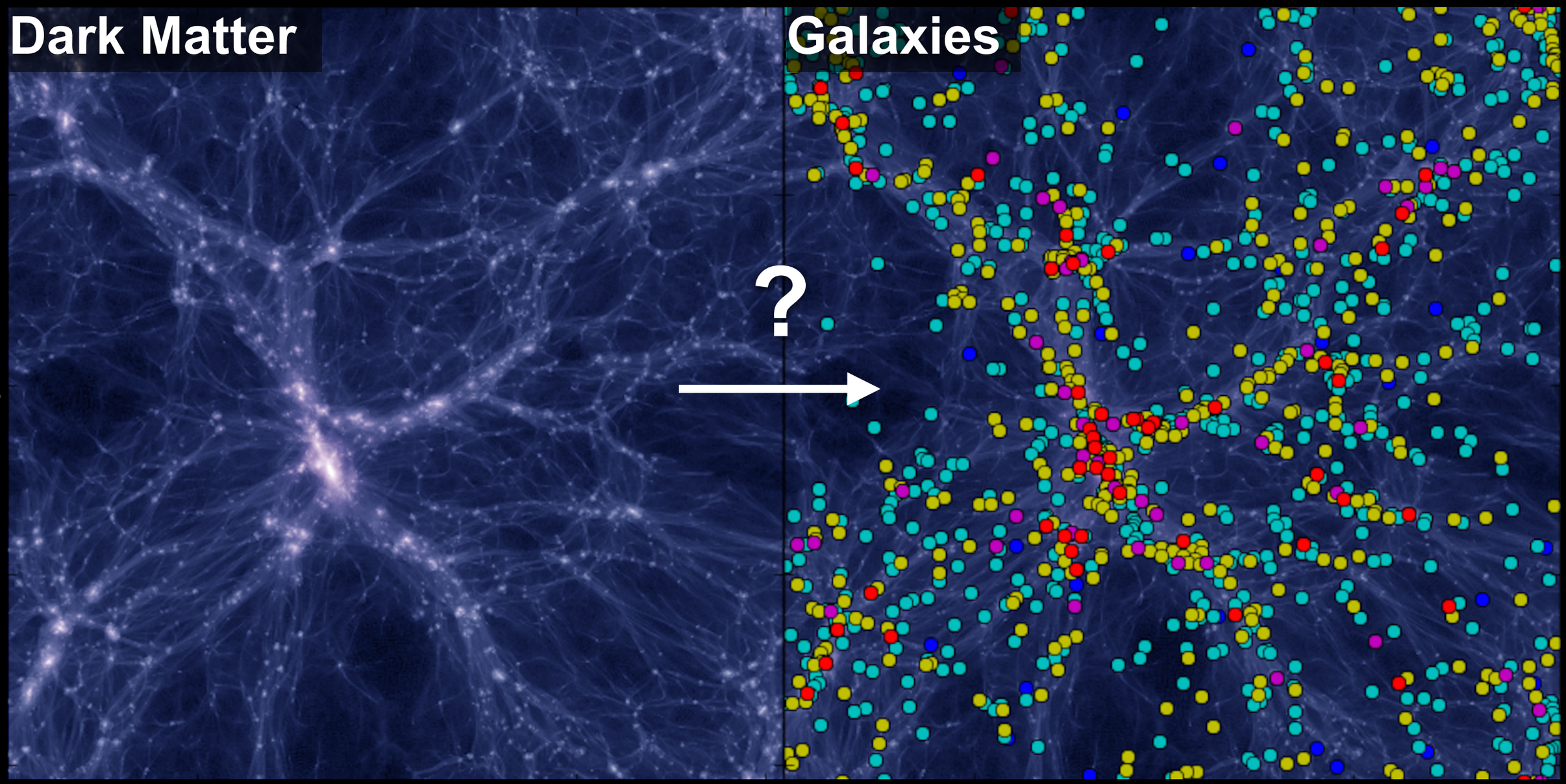
Adapted from Madau & Dickinson, ARAA, **52,** 412 (2014)

WFIRST Science over Cosmic History



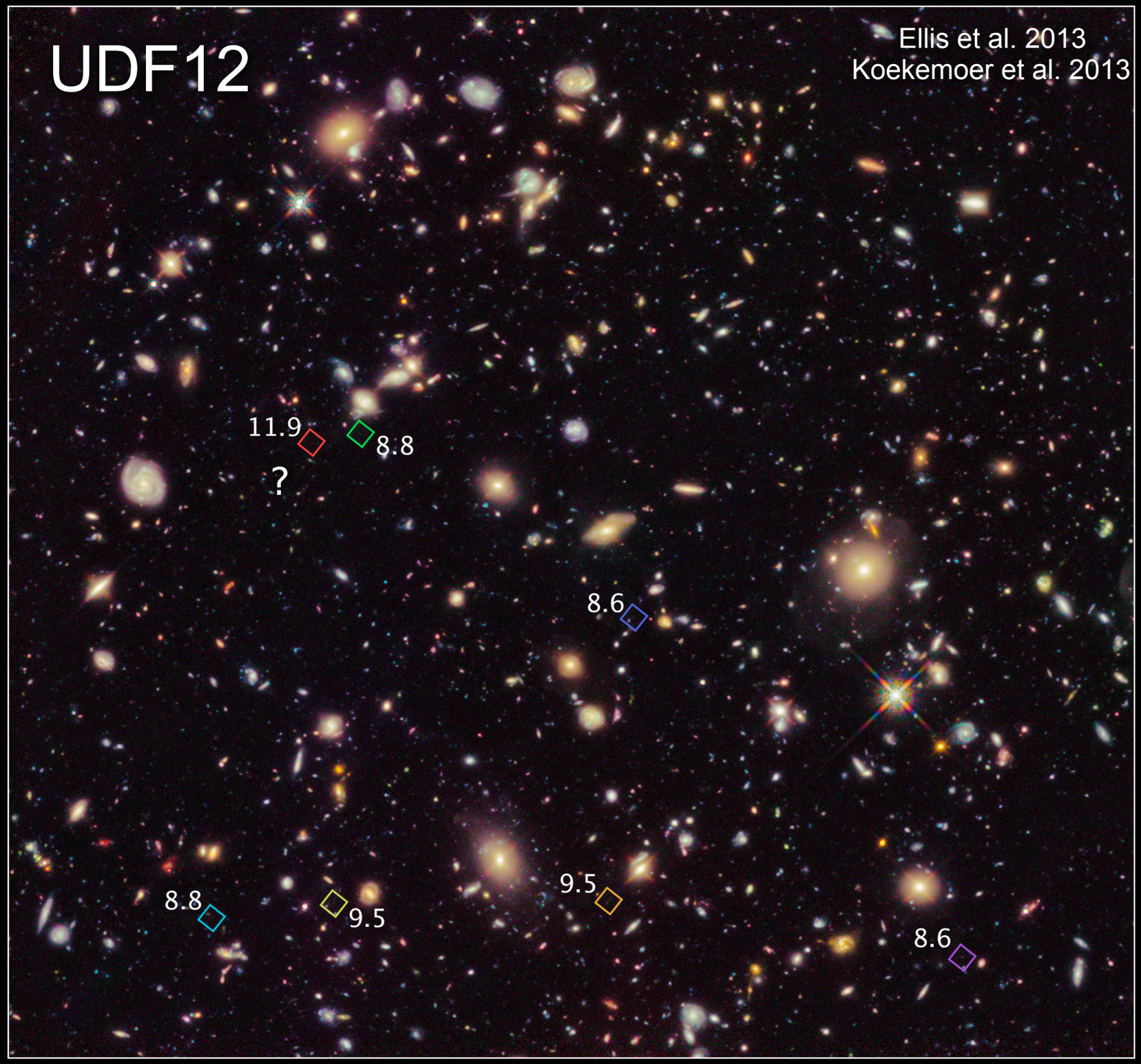
Adapted from Madau & Dickinson, ARAA, **52,** 412 (2014)

WFIRST Provides a Cosmic Context

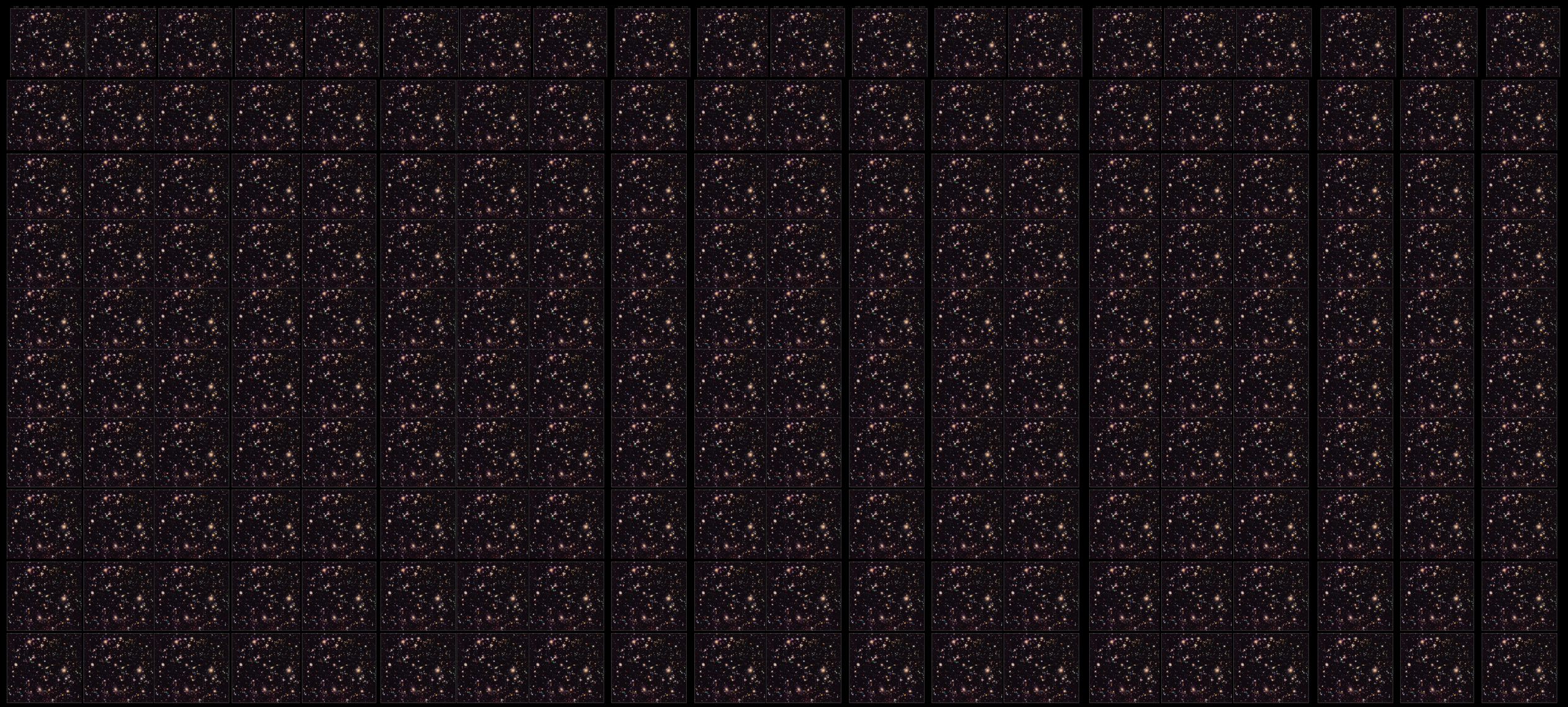


How do galaxy properties map onto dark matter structures?
How does cosmic environments affect galaxy evolution?

WFIRST Surveys Enormous Areas



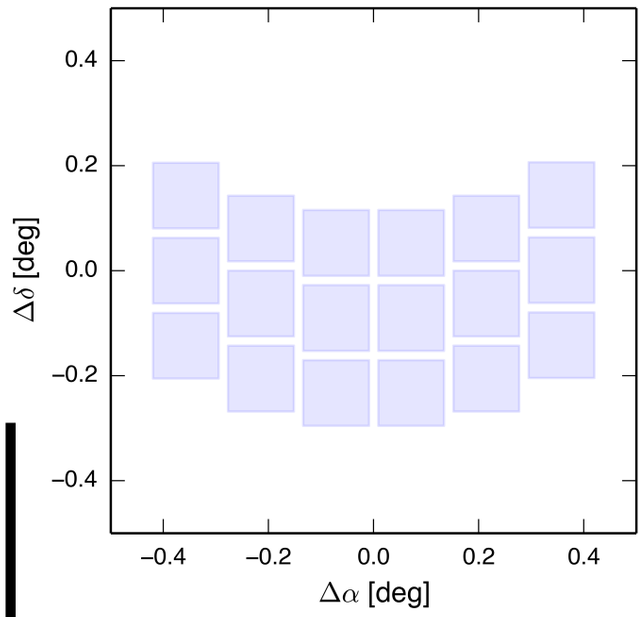
WFIRST Surveys Enormous Areas



WFIRST field of view is >100x *HST* WFC3, with similar sensitivity.

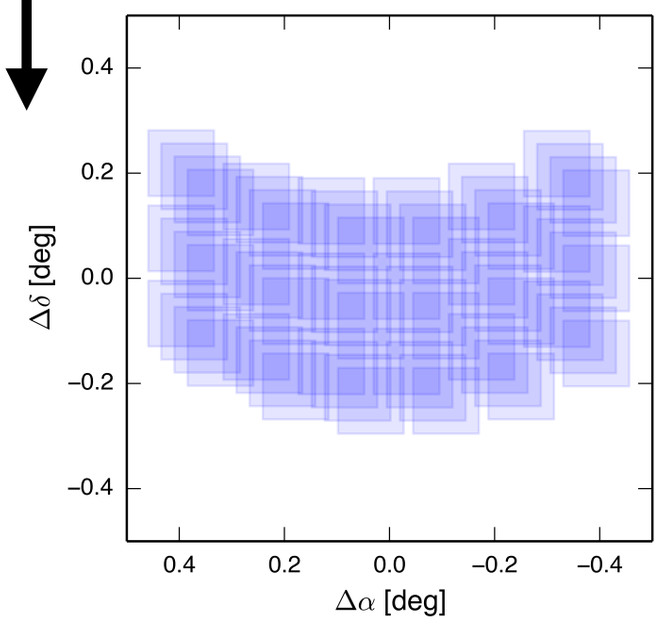
The Survey Power of *WFIRST*

Single Pointing



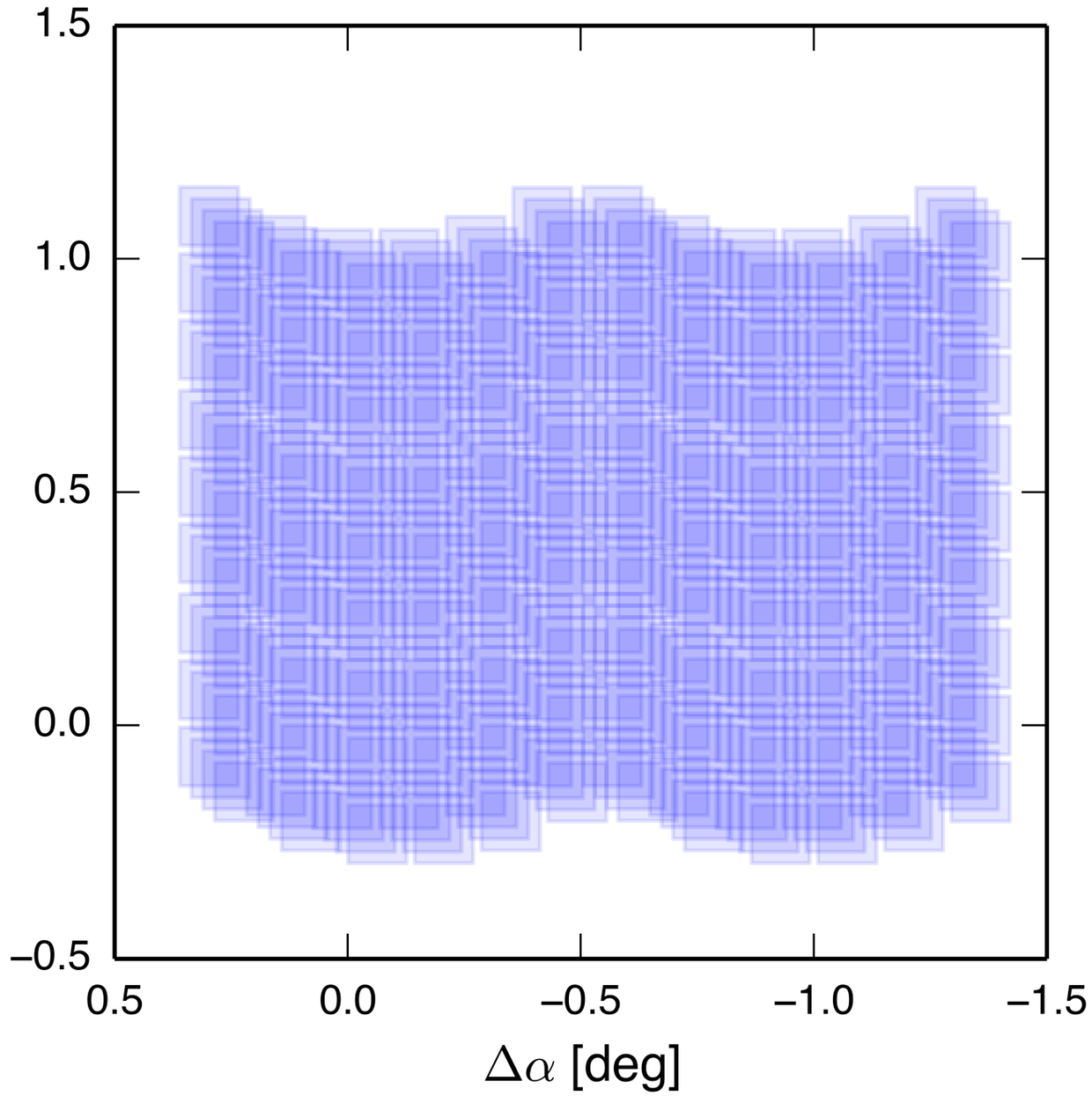
4 dithers

Filled Focal Plane

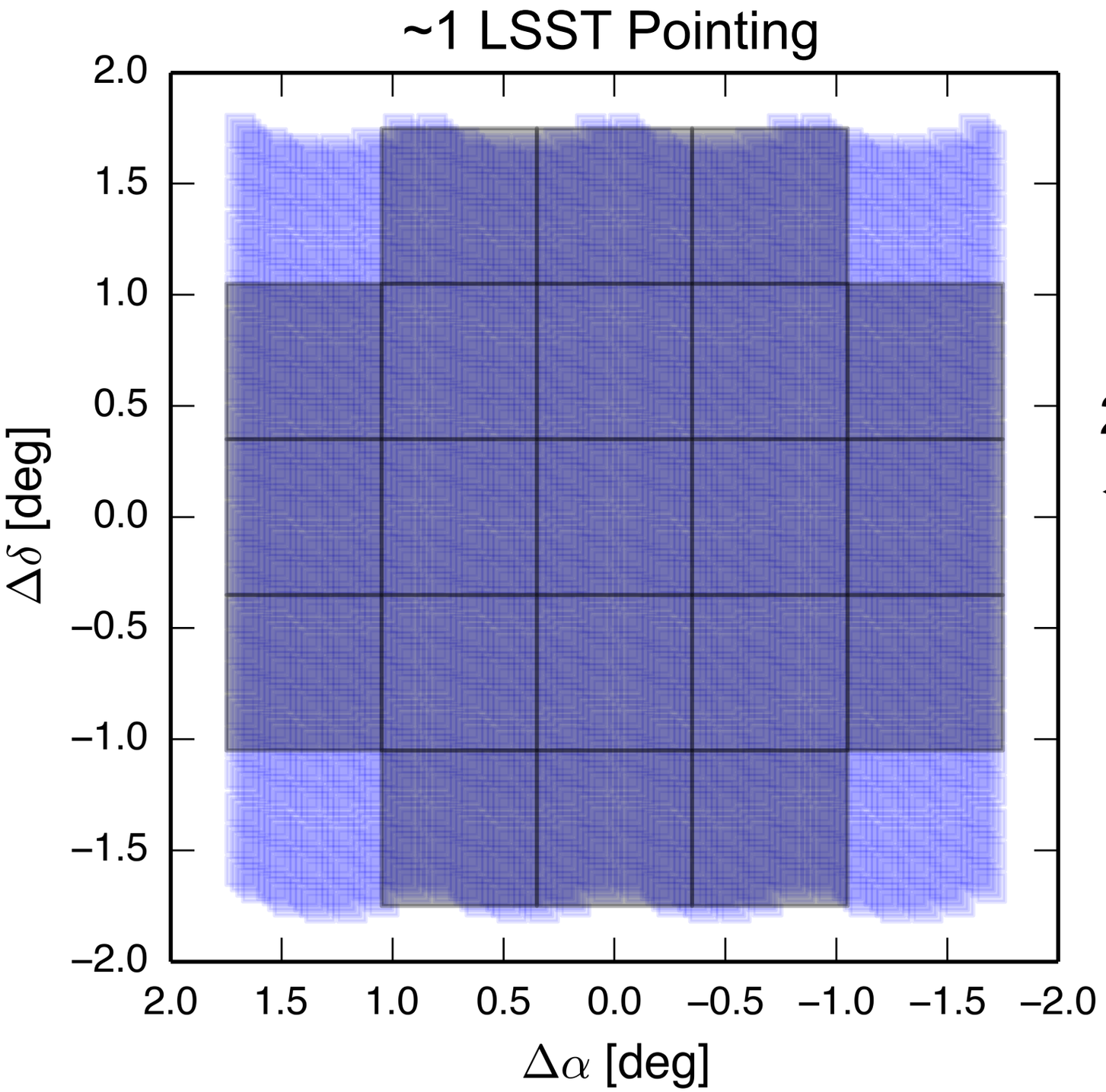


2x3 tiling

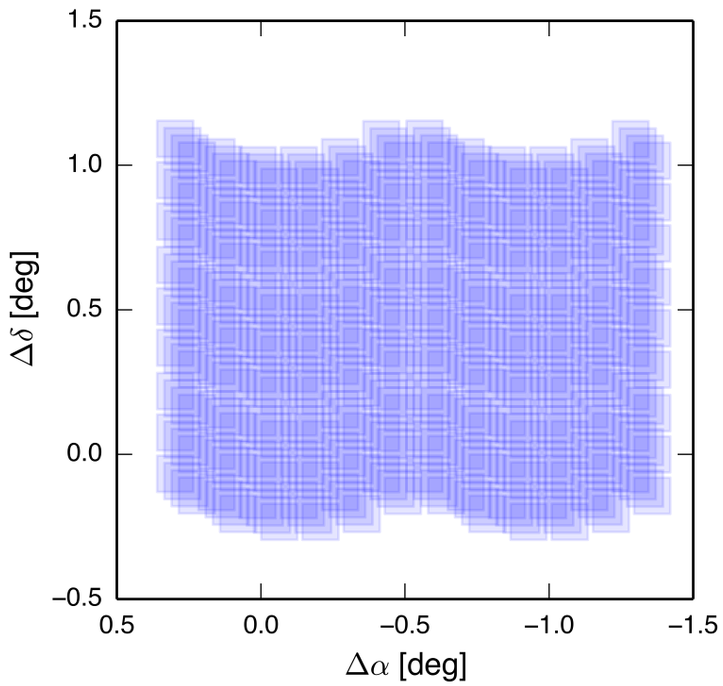
~2 deg^2 Field



The Survey Power of *WFIRST*

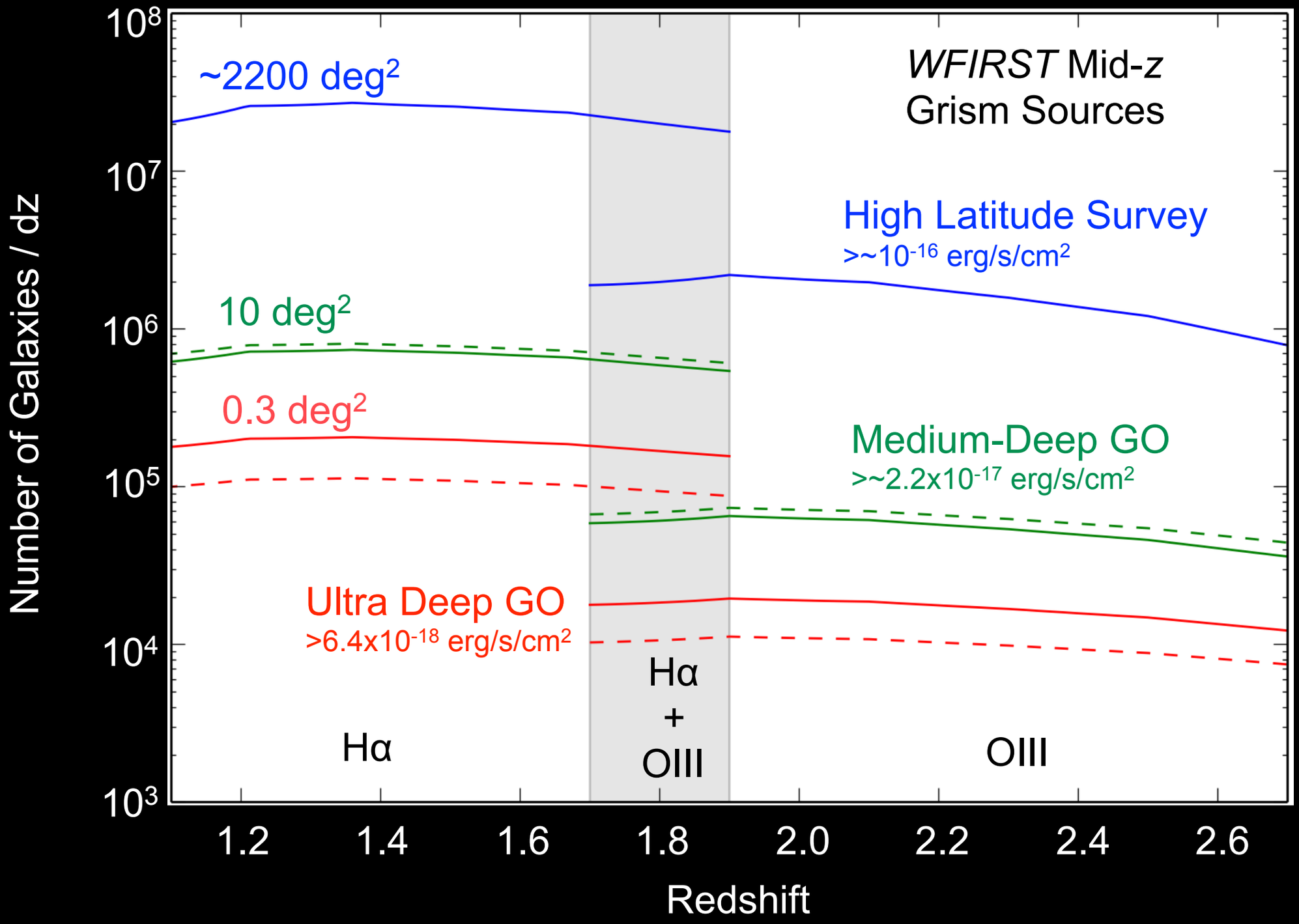


2x3 tiling



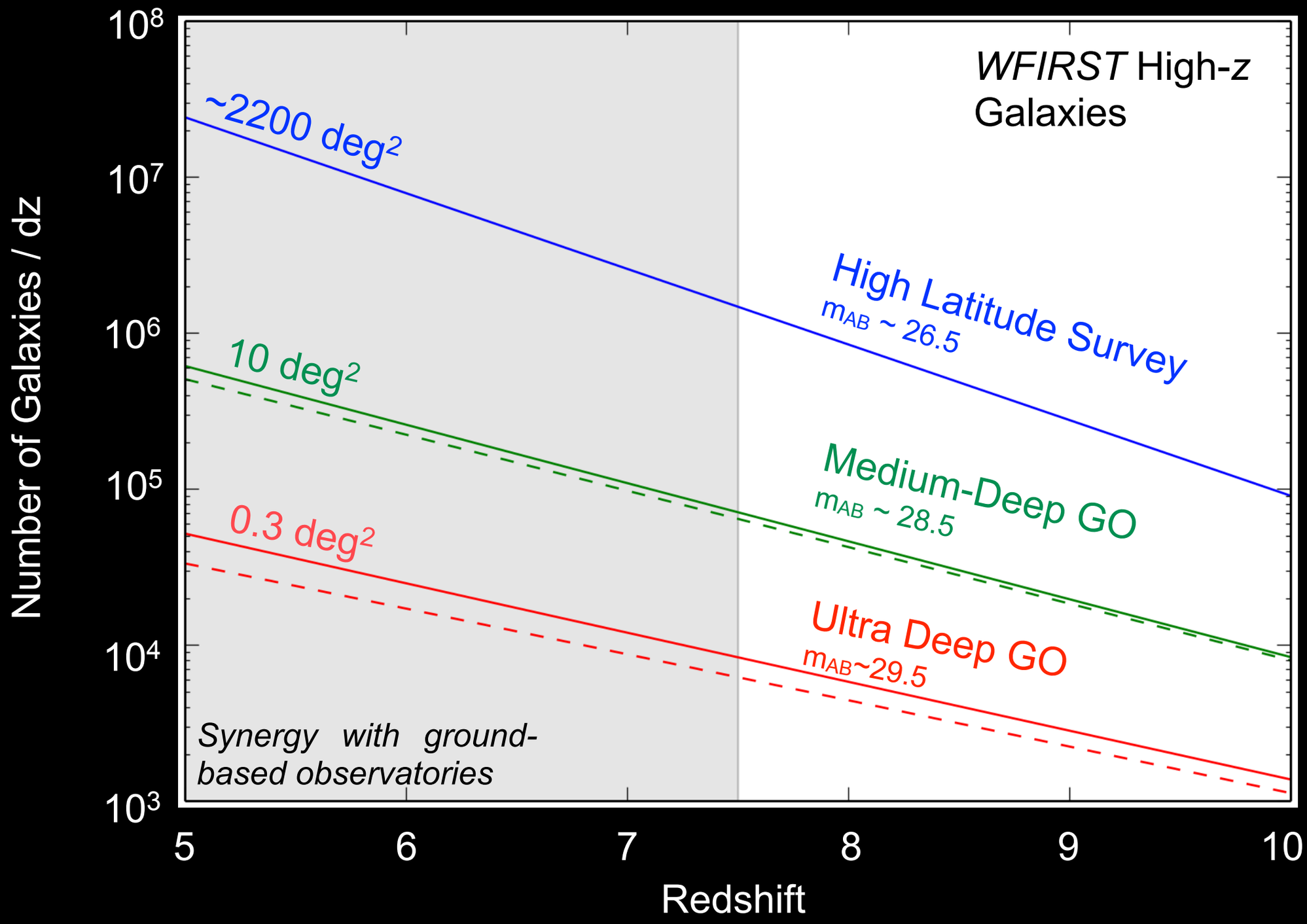
WFIRST will survey ~2200 deg² to the same depths reached by HST, discovering millions of high-redshift galaxies!

WFIRST Spectroscopy Reveals Galaxy Formation



WFIRST enables spectroscopic studies at the peak of star formation.

WFIRST High Redshift Galaxy Counts



WFIRST will discover statistical samples of reionization epoch galaxies.

WFIRST Extragalactic Potential Observations (EXPO) Science Investigation Team

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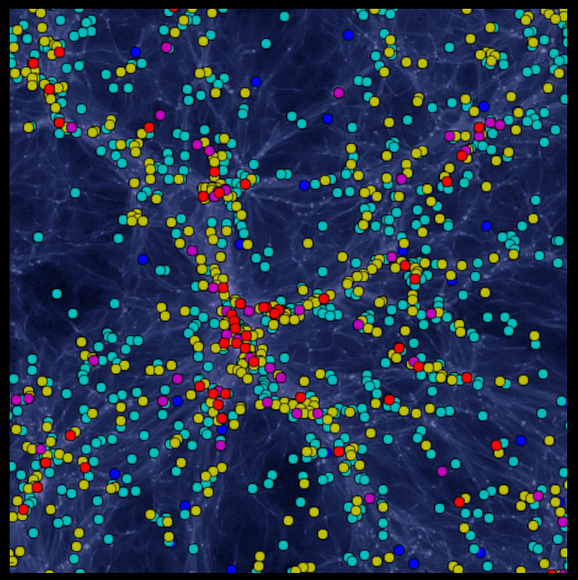
WFIRST Science Questions for Discovering the Earliest Galaxies

- How will WFIRST help us understand the relation between galaxies and their environments over cosmic time?
- What can WFIRST tell us about galaxy formation through the evolving population of rest-frame optical line emission?
- How can we leverage WFIRST to discover and characterize rare AGN and quasars?
- Will the massive sample of gravitational lenses discovered by WFIRST inform us about the properties of dark matter?
- Can we quantify the importance of galaxies and quasars for reionization through the statistical samples finally delivered by WFIRST?
- Will WFIRST discover enough exotic, distant supernovae to tell us about the fates of early stellar populations?

Summary



- *WFIRST* will be transformative for studies of galaxy evolution and formation.
- *WFIRST* can teach us about the connection between galaxy evolution and cosmic environment.
- *WFIRST* will provide unprecedented spectroscopic samples during the peak of galaxy formation.
- *WFIRST* will provide the first statistical samples for studying early galaxy and quasar populations that cause cosmic reionization.