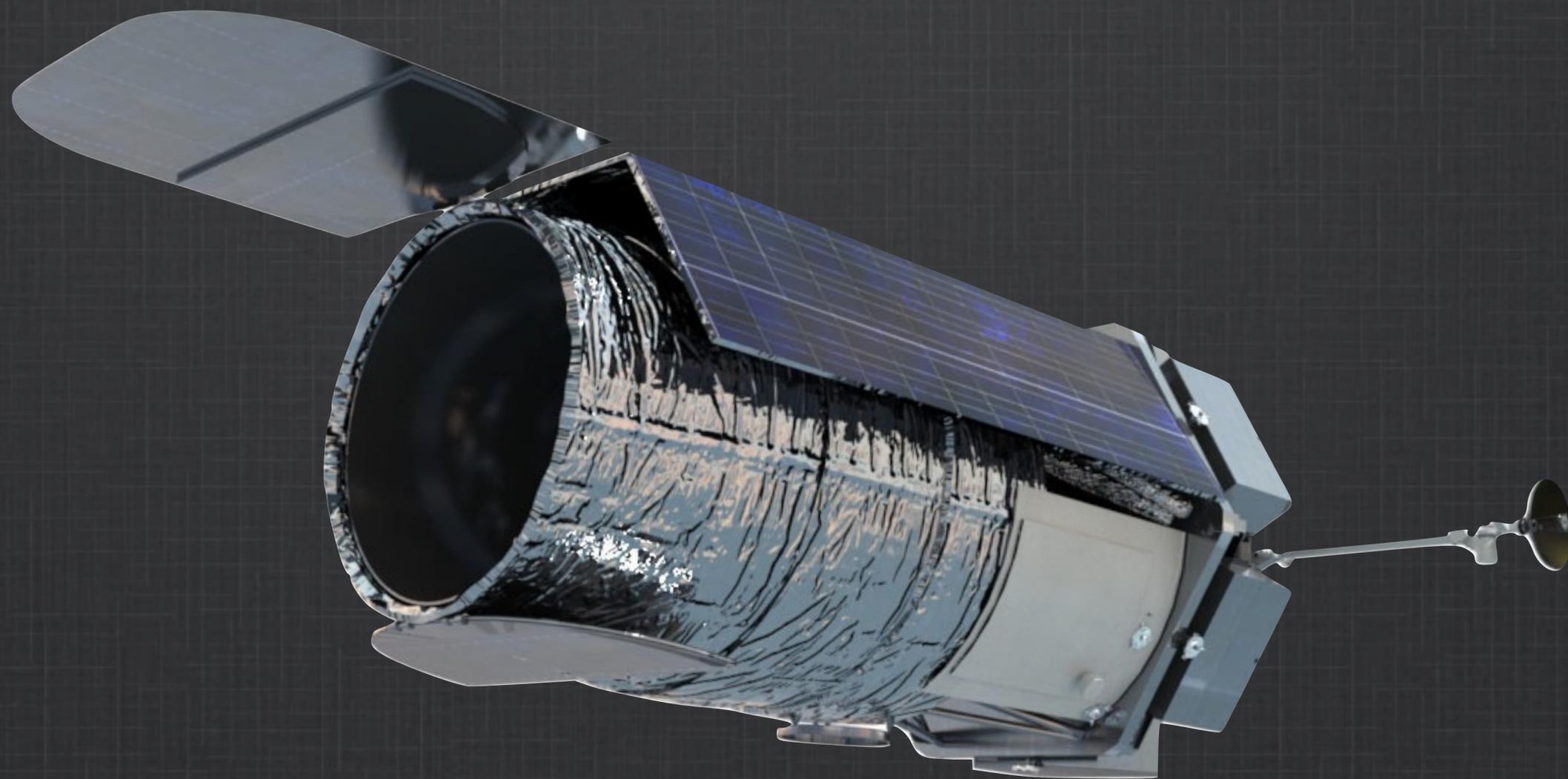


WFIRST Guest Observer Science



Jason Kalirai (JHU, STScI)

SIT Members: C. Conroy (CfA), A. Dressler (OCIW), M. Geha (Yale),
E. Levesque (UW), J. Lu (IfA), J. Tumlinson (JHU, STScI)

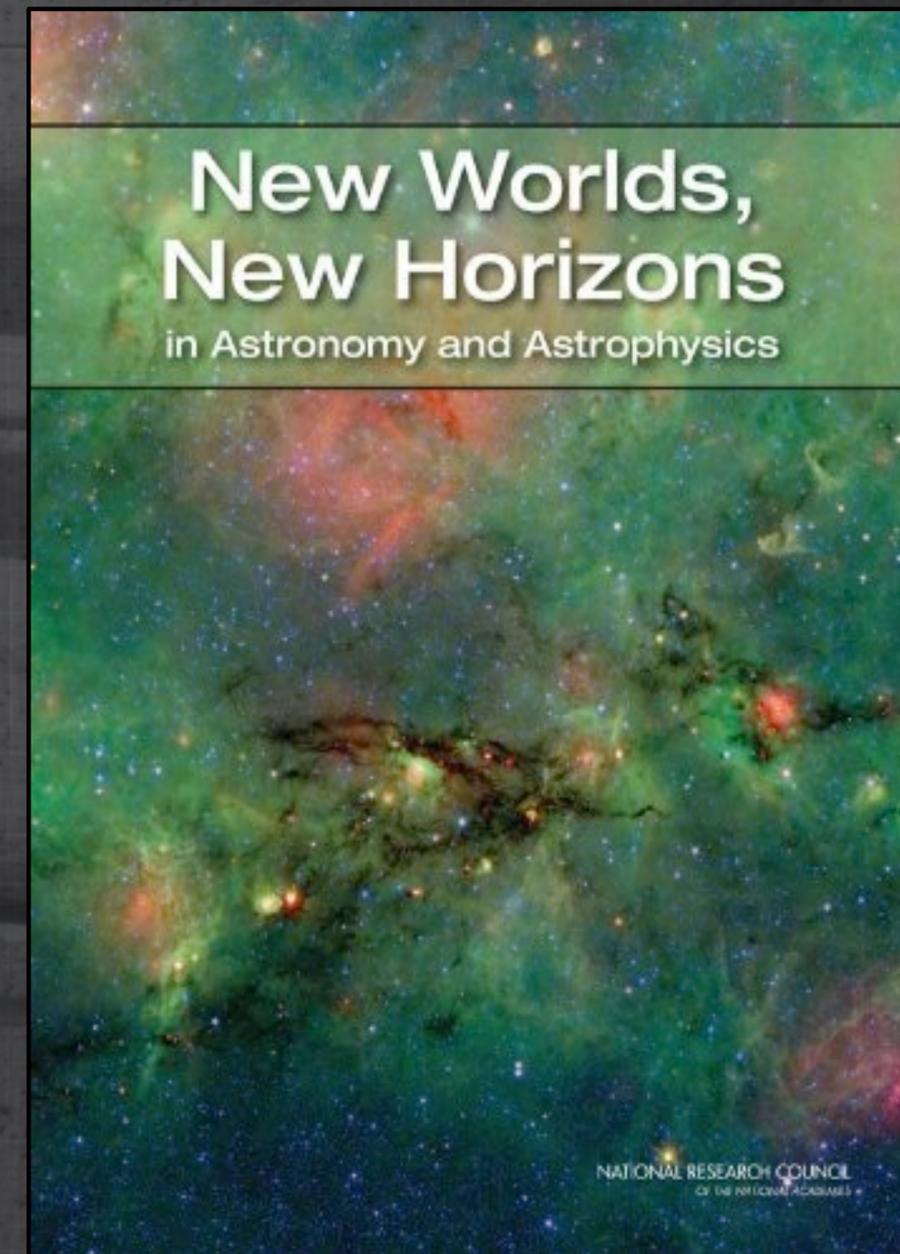
The Guest Observer Program has Always Been a Part of the WFIRST Foundation

Panel Reports - New Worlds, New Horizons in Astronomy and Astrophysics

“A significant fraction of the first 5 years will also be used for surveys and smaller peer-reviewed guest-observer projects that will investigate, for example, galaxy evolution, stellar populations of nearby galaxies, and the plane of the Milky Way galaxy”

“The combination of depth, area, and quality of WFIRST data in the infrared will easily surpass that any other ground-based or space-based facility. WFIRST research bears substantially on 10 of the 20 key questions posed in the Astro2010 Science Frontiers Panel reports (see Table 6.2).”

“The ability of a single facility to have such broad impact, and its combination of affordability, technical readiness, and low risk, is why the EOS recommends WFIRST as the next large U.S. space mission.”



The Guest Observer Program has Always Been a Part of the WFIRST Foundation

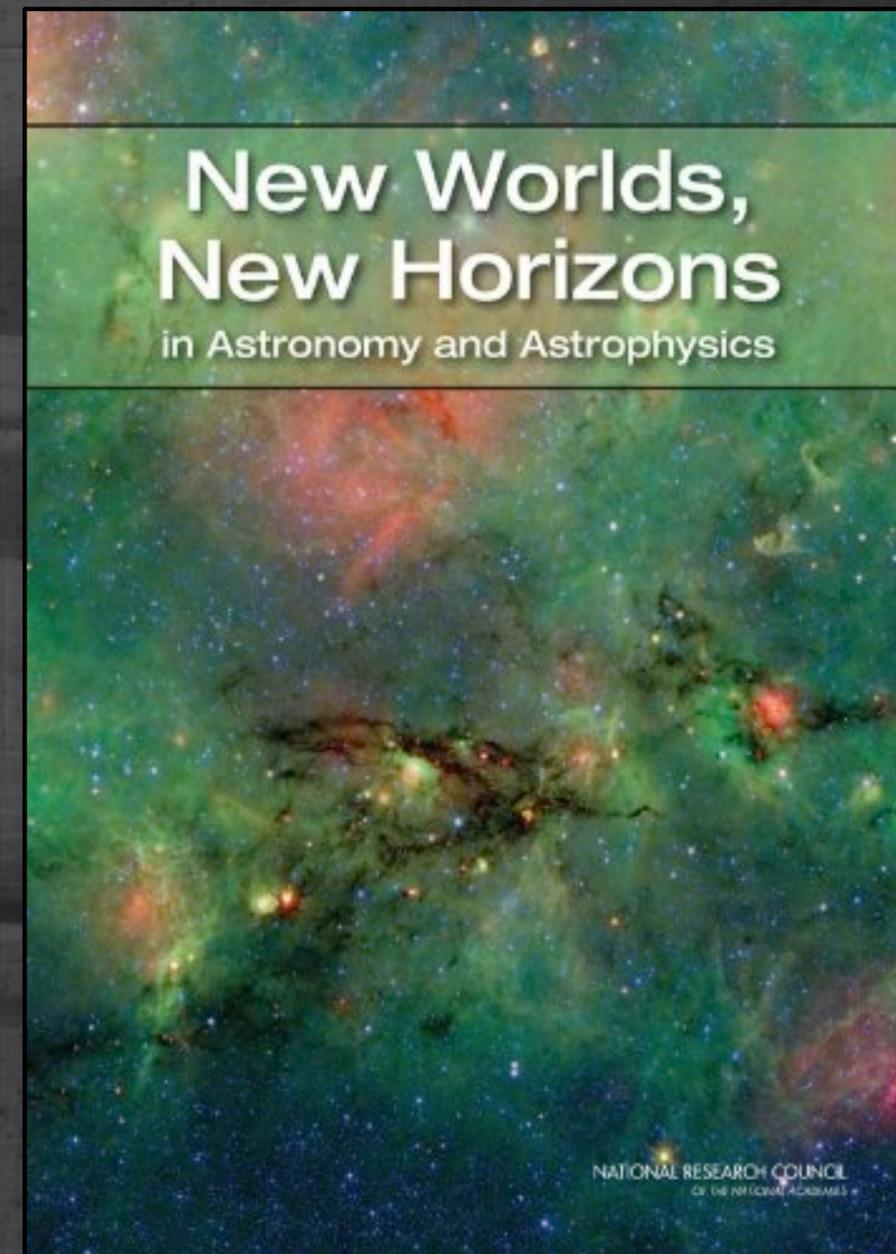
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...that was for a 1.5m telescope, not a 2.4m

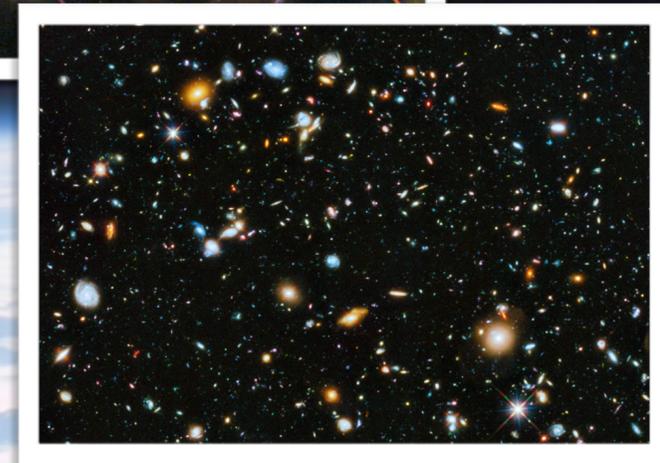
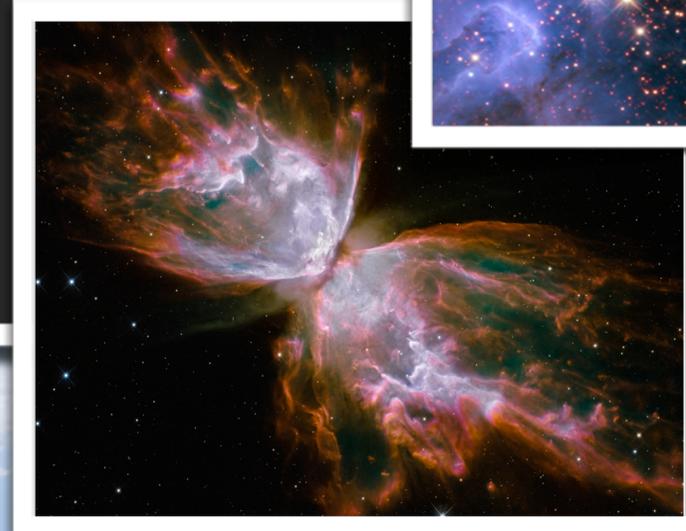
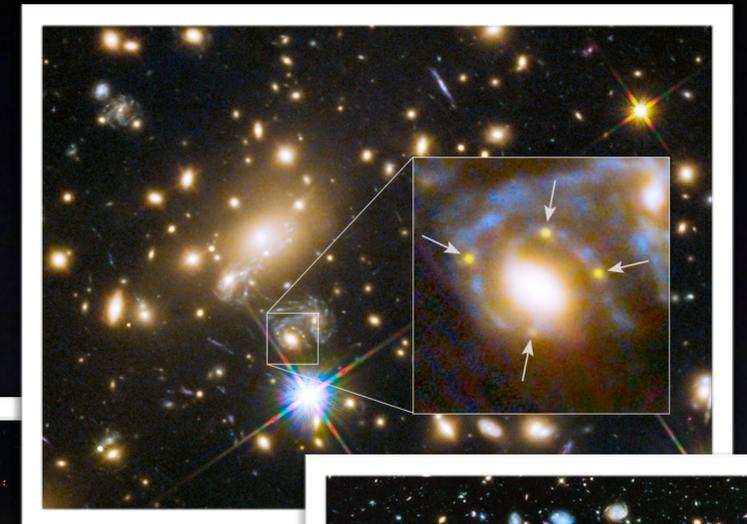
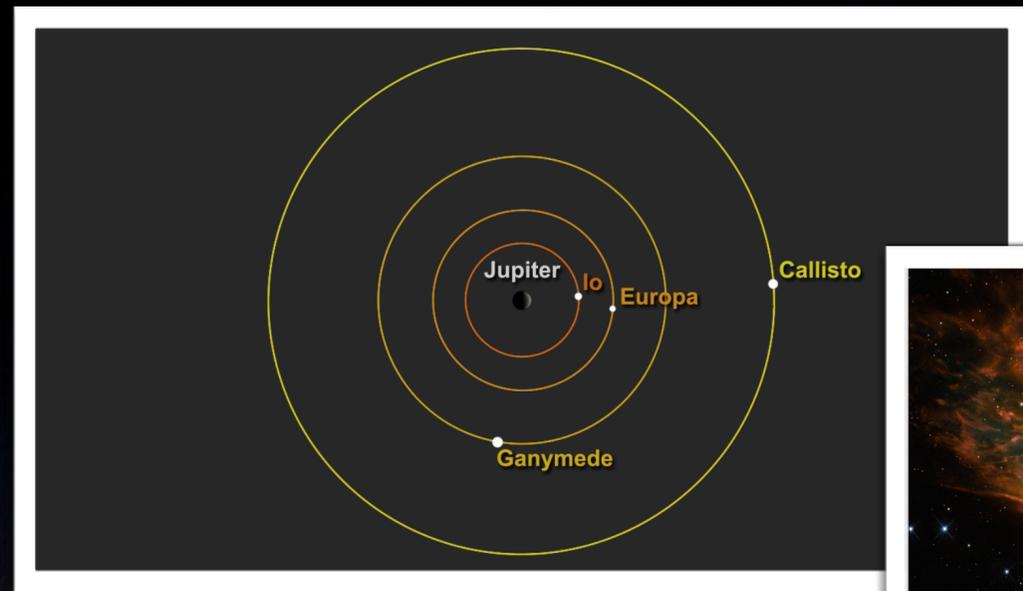
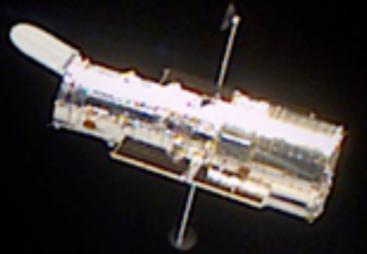


The Great Observatories

A Successful Model for the Guest Observer Program

Our Experience

- ★ Establishes broad **community engagement**
- ★ Tackles **diverse** set of astrophysical **questions** in changing paradigms
- ★ Open **competition** inspires **creativity**
- ★ Ensures long-term scientific **discovery potential**
- ★ For WFIRST, maximizes synergies with **JWST, Euclid, LSST, GSMTs** and other future facilities

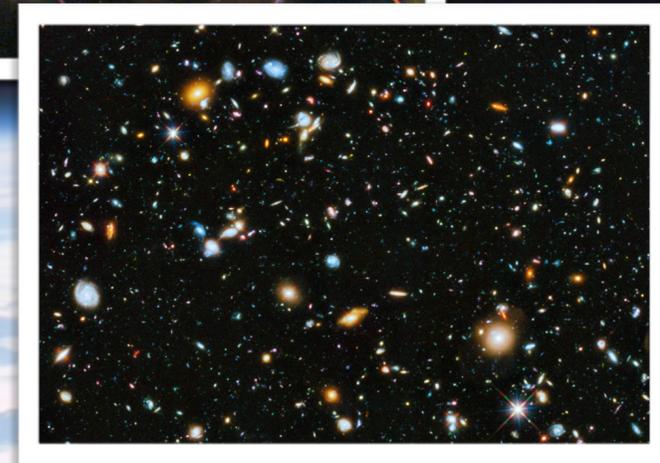
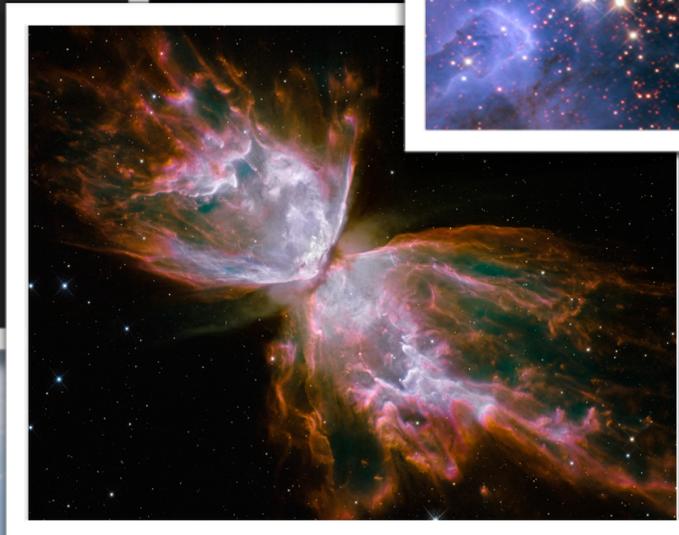
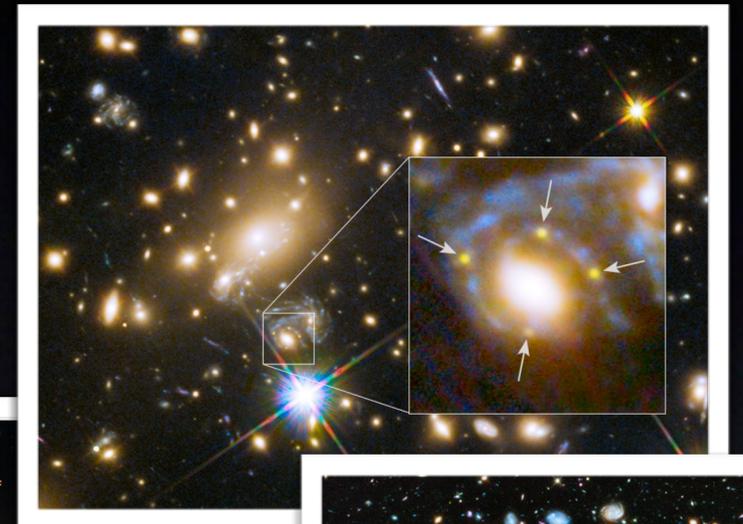
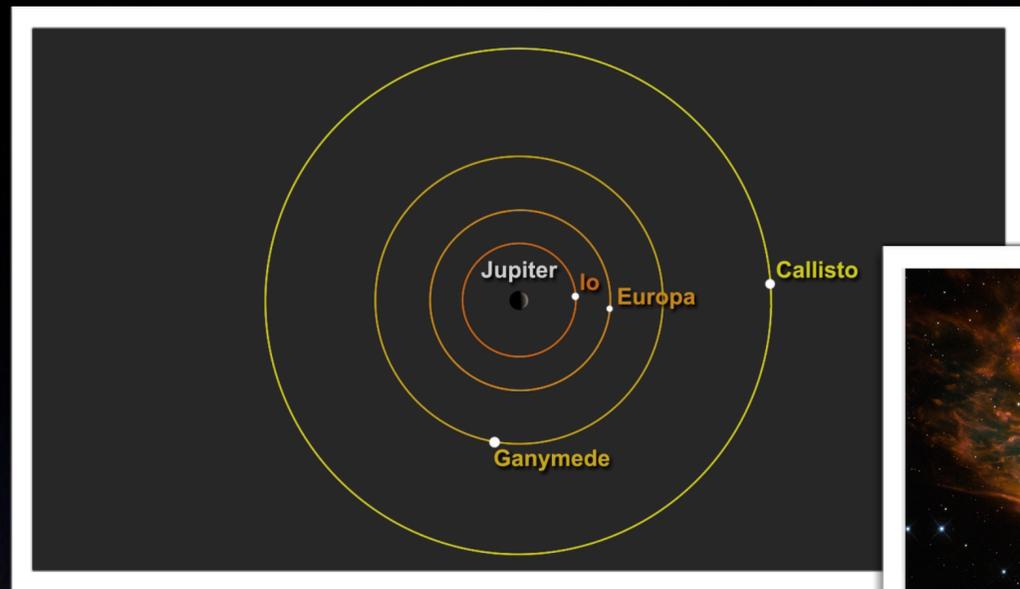
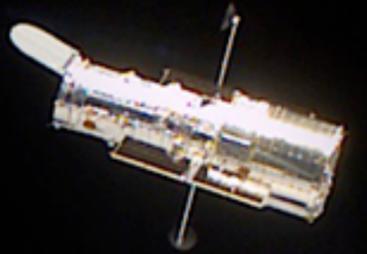


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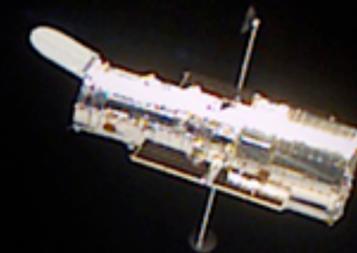


The Great Observatories

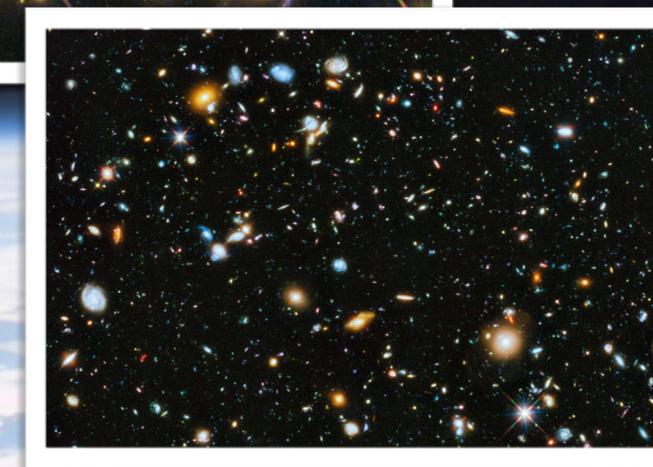
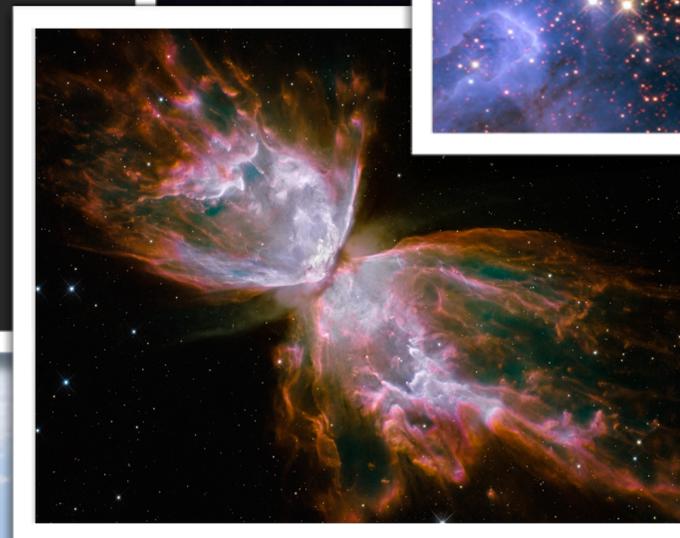
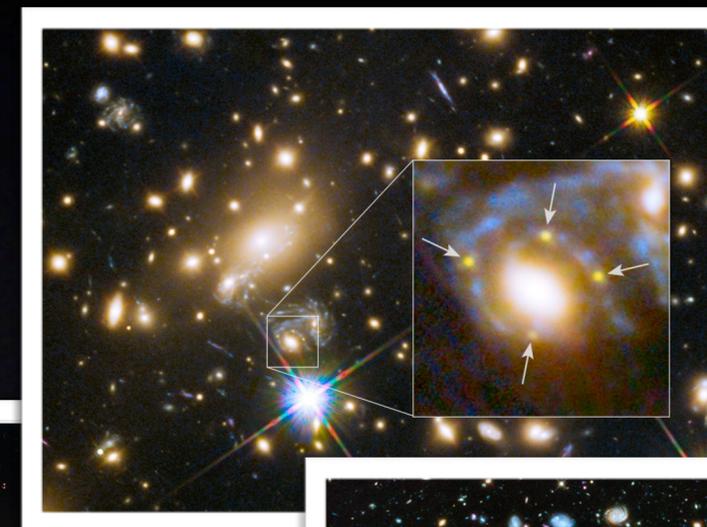
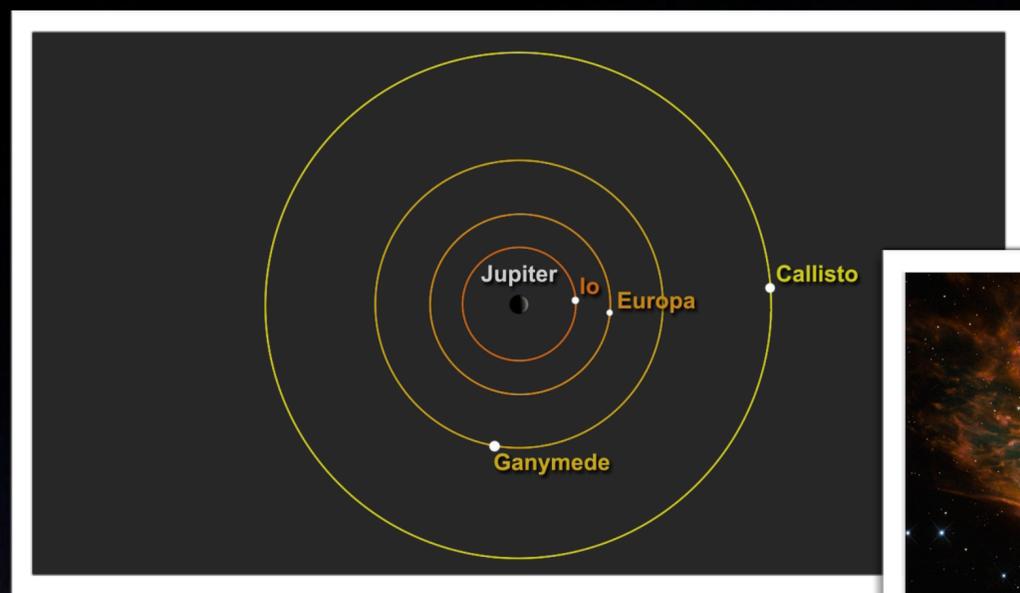
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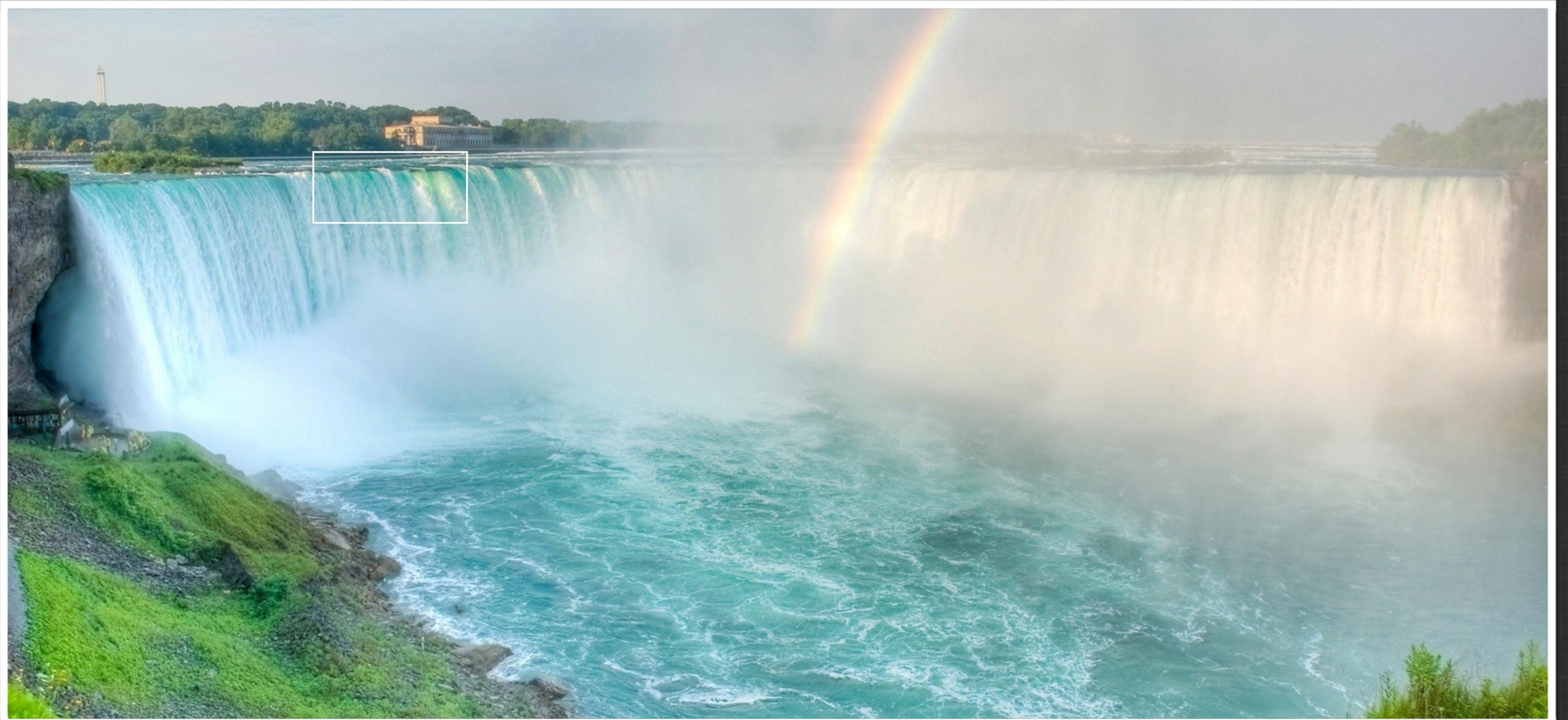
25% of WFIRST is budgeted for GO science



...the forest for the trees



...the forest for the trees

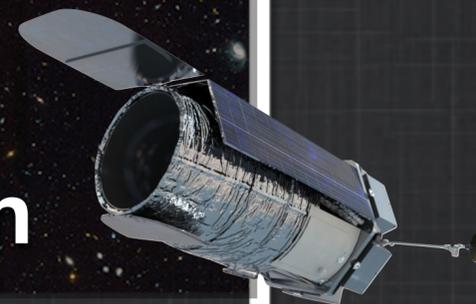


...the forest for the trees



The Hubble Ultra Deep Field

**A GO Program WFIRST Deep Field will measure
1,000,000 galaxies (100+ at $z > 10$) at Hubble-resolution**



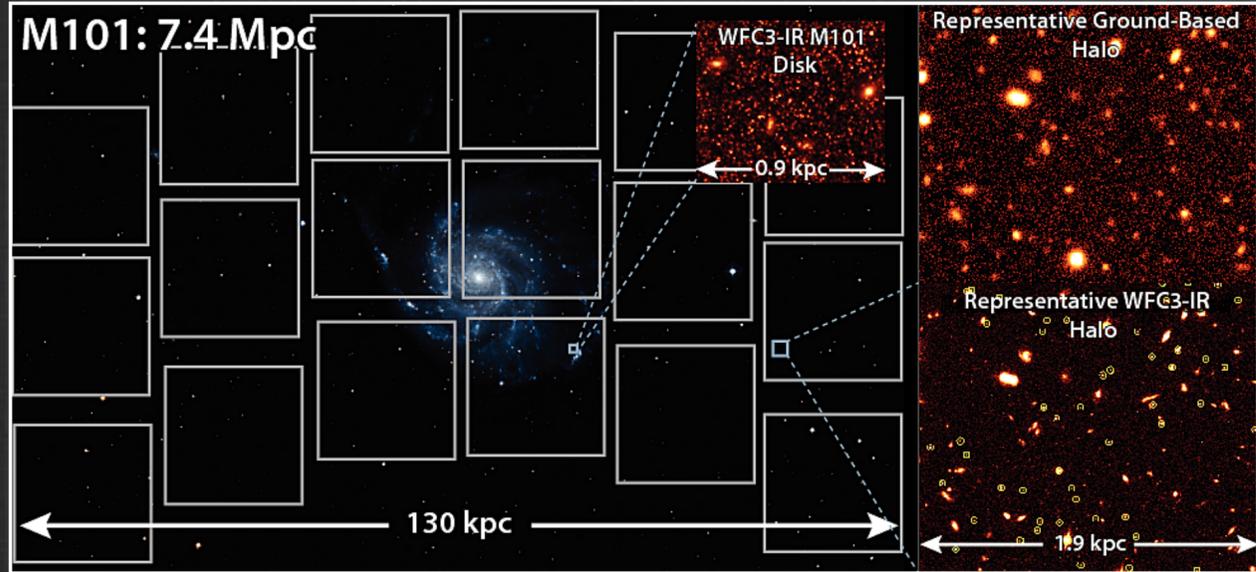
PHAT Movie Here

PHAT Movie Tiling Here

WFIRST GO and GI Science Investigation Teams

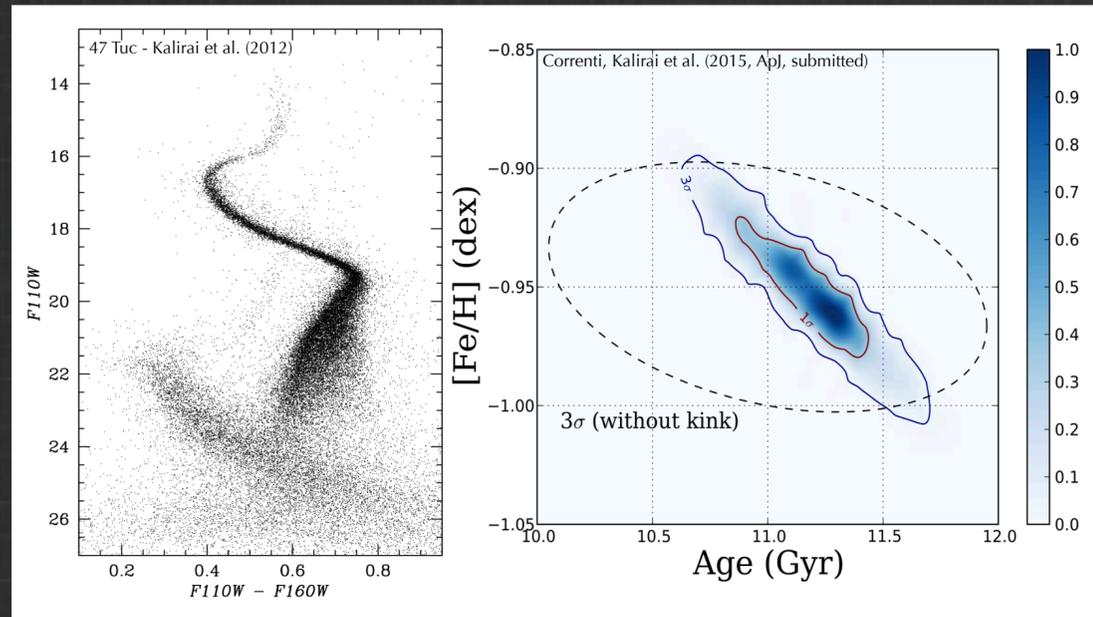
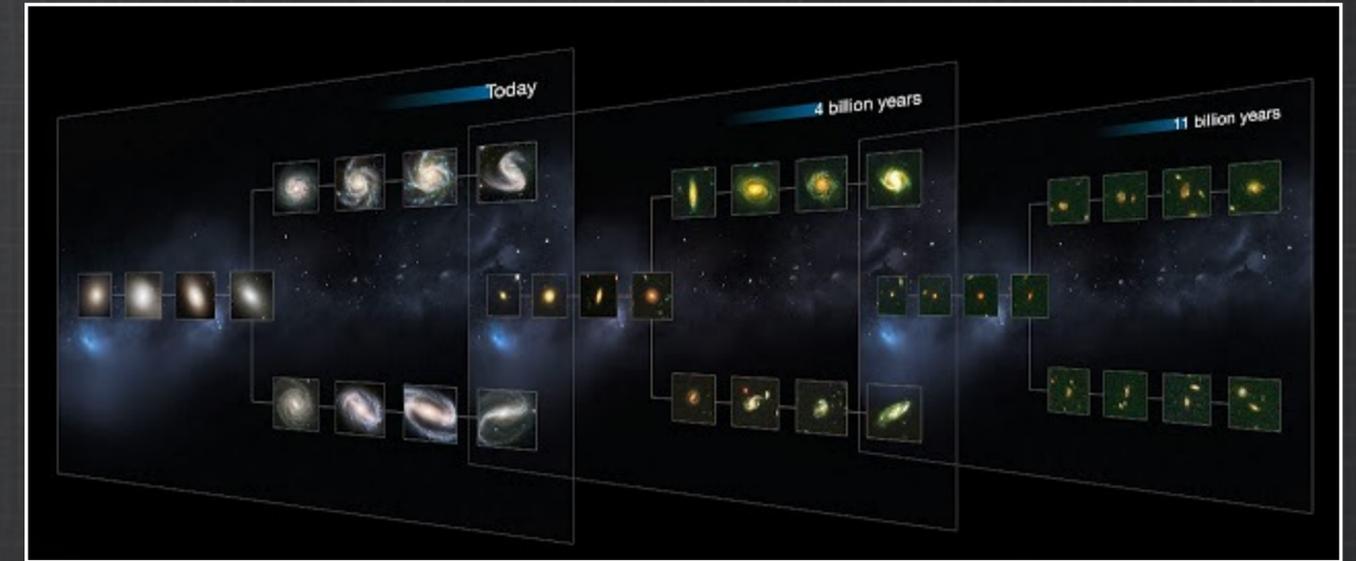
Ben Williams et al.

WINGS: WFIRST Infrared Nearby Galaxy Survey



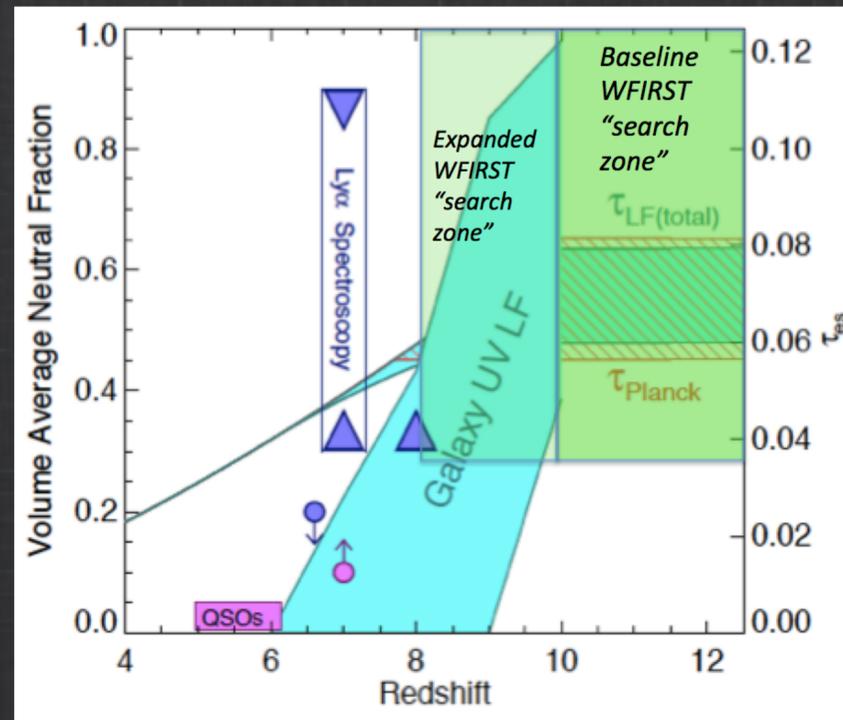
Brant Robertson et al.

WFIRST Extragalactic Potential Observations (EXPO)



Jason Kalirai et al.

Resolving the Milky Way with WFIRST



James Rhoads et al.

Cosmic Dawn with WFIRST



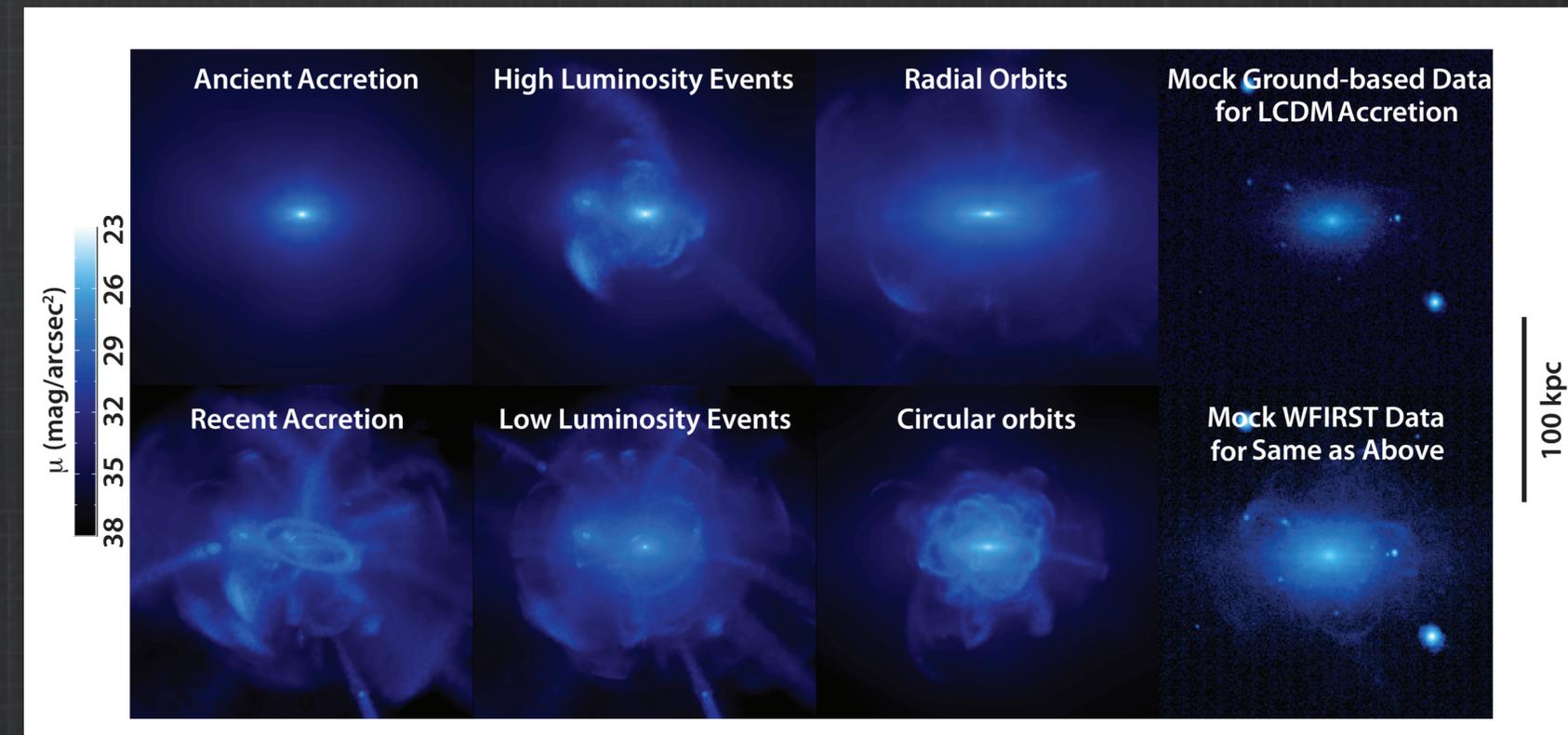
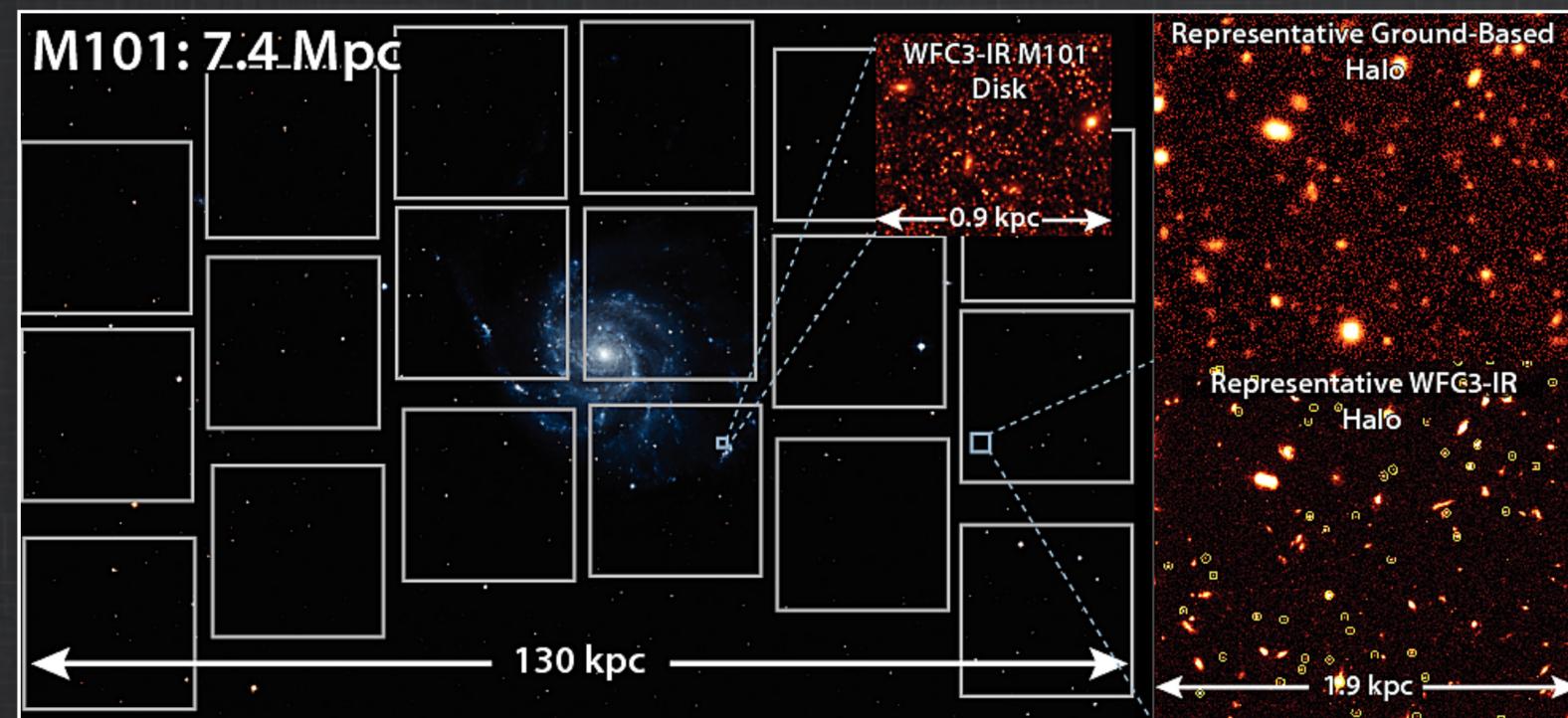
Alex Szalay et al.

Archival Research Capabilities of the WFIRST Data Set

WFIRST GO Science Investigation Teams

PI Ben Williams - WINGS: WFIRST Infrared Nearby Galaxy Survey

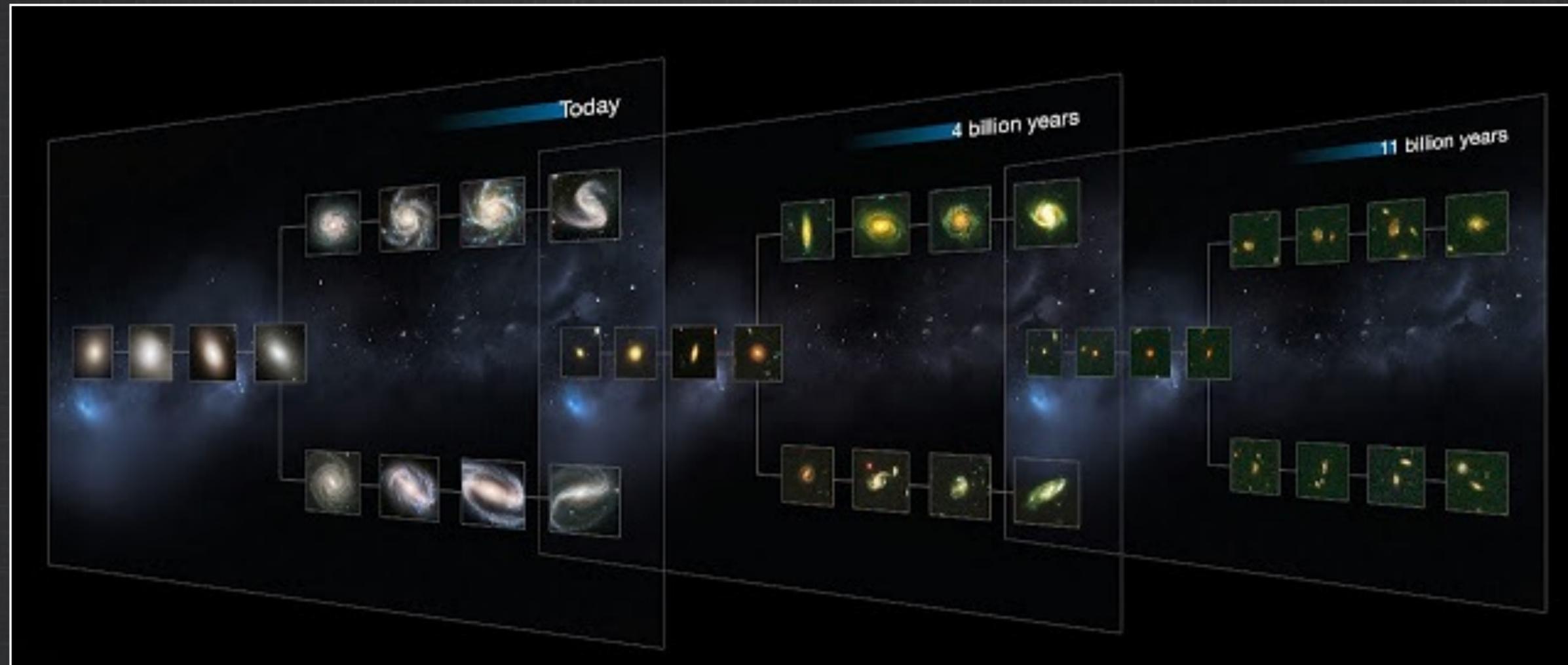
- Measure star count maps and define galaxy structure to ~ 35 mag/sq arcsec (billions of stars within 10 Mpc)
- Test galaxy formation and dark matter models on galactic (and even sub-galactic) scales
- Measure the detailed evolution of nearby galaxies from resolved stellar photometry
 - reconstruct the history of star formation in the nearby Universe
 - put constraints on theoretical models to interpret near infrared extragalactic observations
- Program will model the halo structure and resolved stellar populations to optimize WFIRST constraints on both dark matter halo structure and galaxy formation models in the local Universe



WFIRST GO Science Investigation Teams

PI Brant Robertson - WFIRST Extragalactic Potential Observations (EXPO)

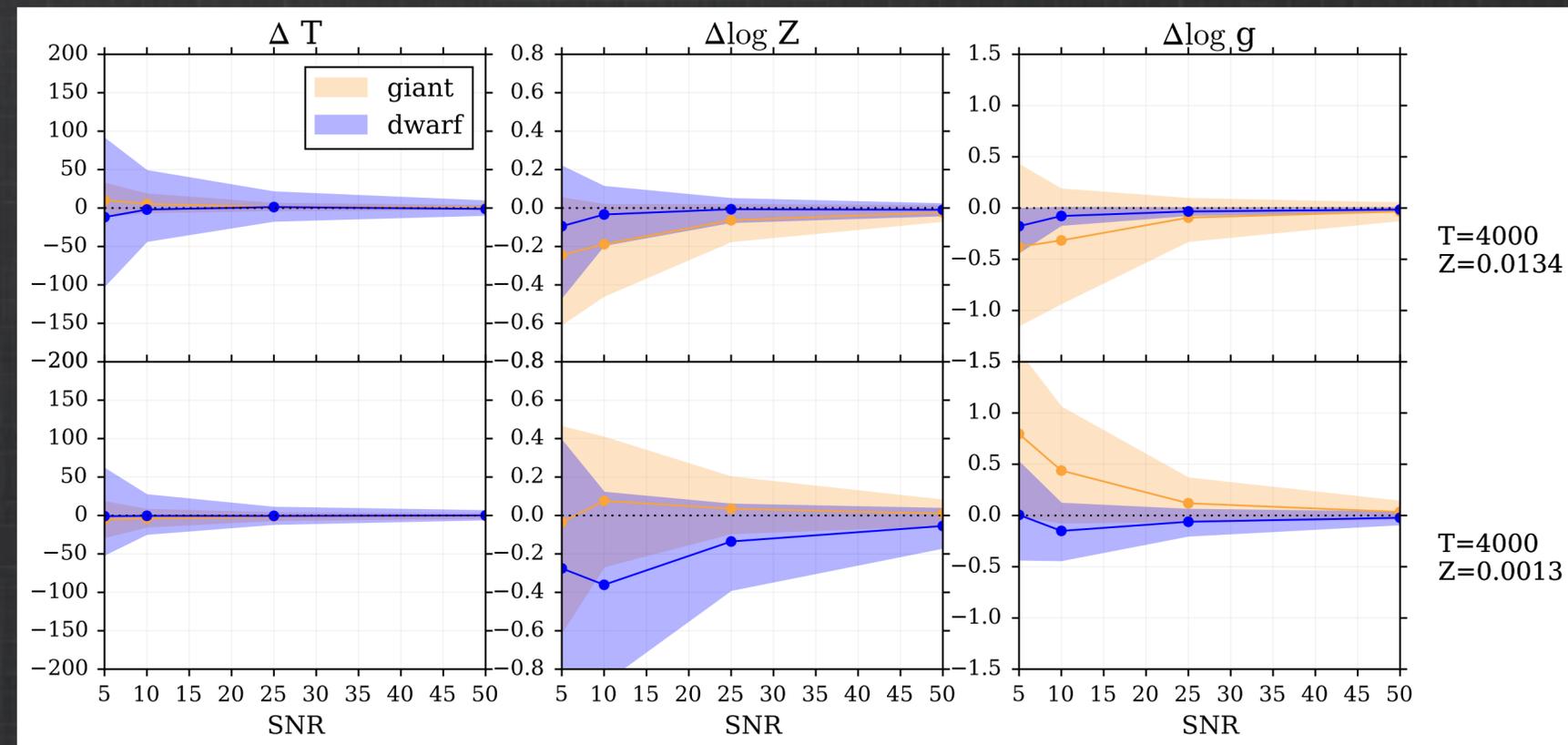
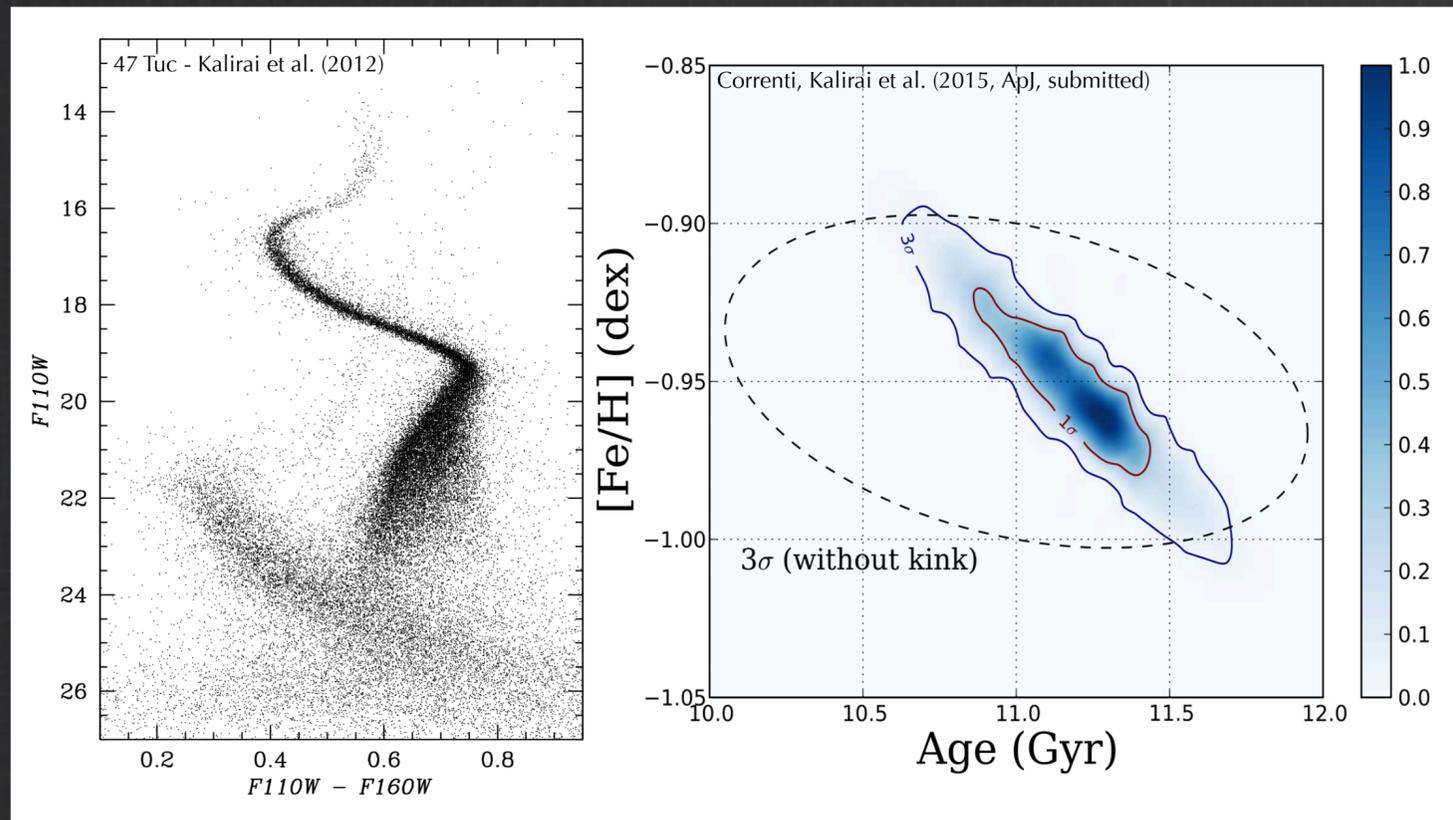
- Understanding the relation between galaxies and their environments over cosmic time
- Galaxy formation through the evolving population of rest frame optical line emission
- Discover and characterize rare AGN and quasars
- Informing properties of dark matter through gravitational lenses
- The importance of galaxies and quasars for reionization
- Exotic, distant supernovae and the fates of early stellar populations



WFIRST GO Science Investigation Teams

PI Jason Kalirai - Resolving the Milky Way with WFIRST

- Includes star forming regions, young clusters, globular clusters, inner disk, central region, halo, dwarf galaxies
- Characterize the IR color-magnitude relation over all ages and metallicity
- High precision measurements of the age-metallicity relation and hydrogen burning limit
- The Milky Way mass budget and the variability of the IMF
- Bringing IR diagnostics to bear on the “multiple populations” problem
- Structure of the inner galaxy, dynamics, and star formation history (proper motions)
- Cosmologically interesting ages for fossil streams, major substructure, and ultra faint dwarf galaxies

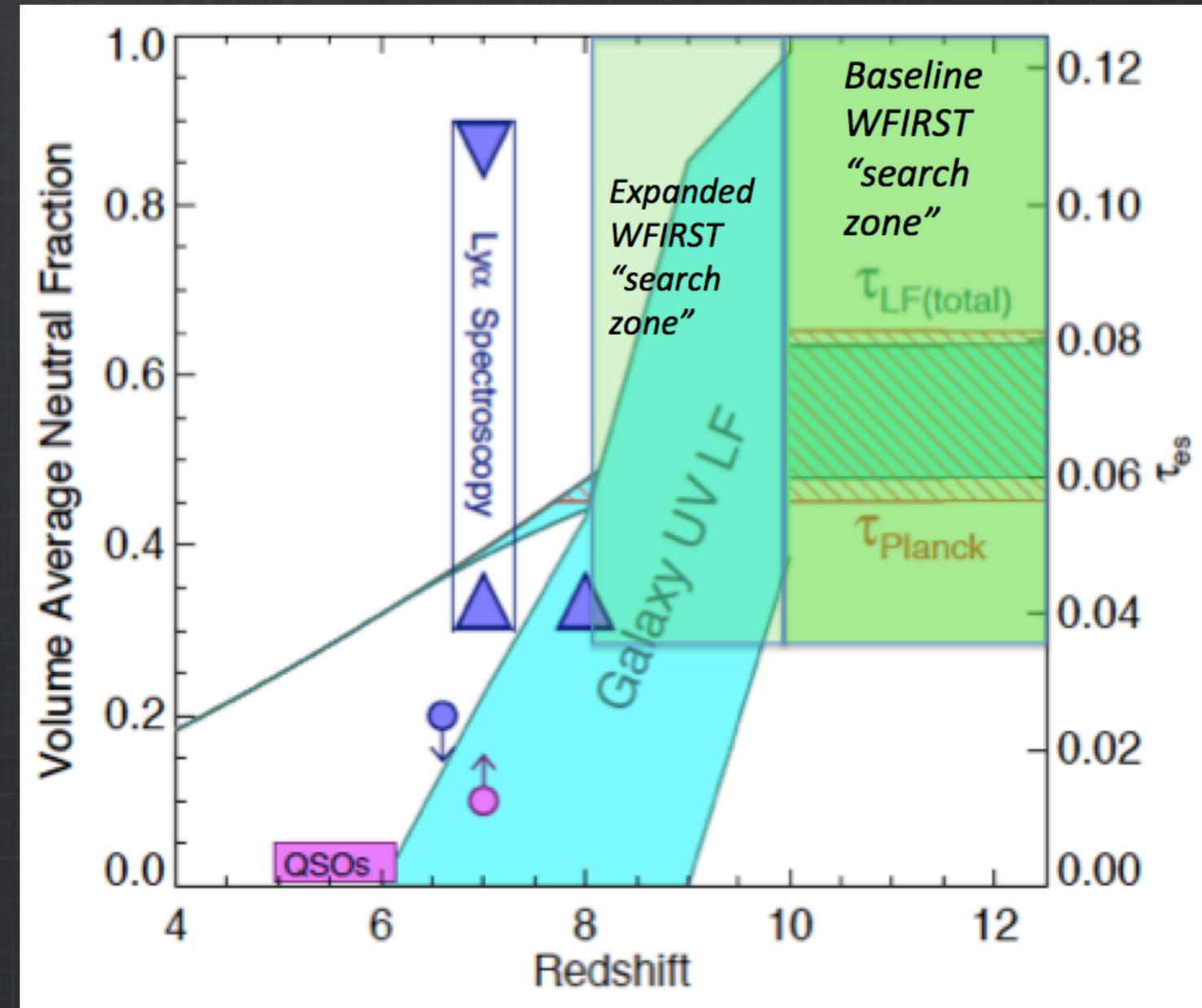


WFIRST GO Science Investigation Teams

PI James Rhoads - Cosmic Dawn with WFIRST

Epoch-of-reionization science with samples of millions of galaxies and thousands of quasars at $z > 7$

- Measures of ionizing photon budget from $z=6$ to 10, from both galaxies and AGN
- Dependence of galaxy properties on environment
- Direct constraints of the intergalactic neutral fraction
 - Grism searches for Lyman alpha galaxies, on scales larger than reionization bubbles
 - Follow up spectra of WFIRST quasars



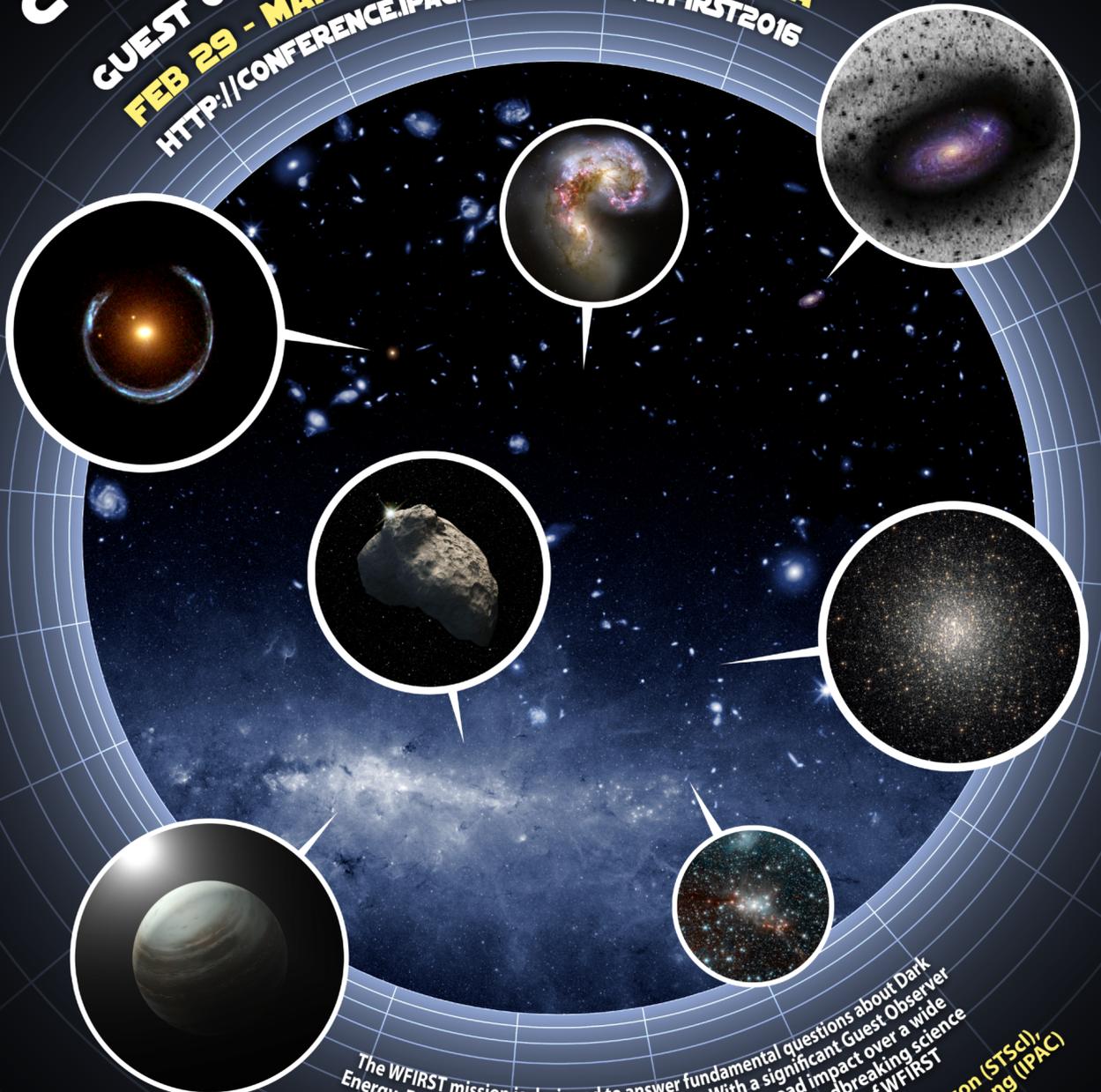
WFIRST GI Science Investigation Teams

PI Alex Szalay - Archival Research Capabilities of the WFIRST Data Set

- Evaluate best archival practices from across all of astronomy
- Design and build simple end-to-end simulations and incorporate into databases
- Establish a common platform for the science teams
- Design and prototype a unified object catalog using a simulated catalog, with xmatches to external surveys
- Identify new forward-looking technologies that don't exist today (e.g., scripting, fast parallel analysis tools)
- Develop algorithms for science use cases and build prototypes of highly scalable parallel tools (e.g. angular and spatial cross-correlations inside the DB)
- Implement novel object classification techniques based on machine learning principles



COMMUNITY ASTROPHYSICS WITH WFIRST:
GUEST OBSERVER AND ARCHIVAL SCIENCE
FEB 29 - MARCH 2, 2016 IN PASADENA, CA
[HTTP://CONFERENCE.IPAC.CALTECH.EDU/WFIRST2016](http://conference.ipac.caltech.edu/wfirst2016)



The WFIRST mission is designed to answer fundamental questions about Dark Energy, Exoplanets and infrared astrophysics. With a significant Guest Observer and archival science program, WFIRST will have a broad impact over a wide range of astrophysics. This meeting will focus on the groundbreaking science that can be done with the GO and archival opportunities of WFIRST

Science Organizing Committee: N. Gehrels (GSFC), L. Armus (IPAC), H. Ferguson (STScI), S. Gaudi (OSU), J. Kalirai (STScI), D. Kirkpatrick (IPAC), H. Schlichting (MIT), Y. Wang (IPAC)

IPAC · STSCI

WFIRST Science Conference
Community Astrophysics with WFIRST
 Feb 29-Mar 2, 2016 (Pasadena CA)

WFIRST

