

High-z Galaxies approaching the Reionization Epoch

Sezione “Primi Oggetti Astrofisici”

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On behalf of MA1 group OAR (High-z Galaxies-Imaging)

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Motivation

Are we alone?

How did we get here?

How does the universe work?

Credit: NASA Enduring Quest Daring Visions

Hot Topics

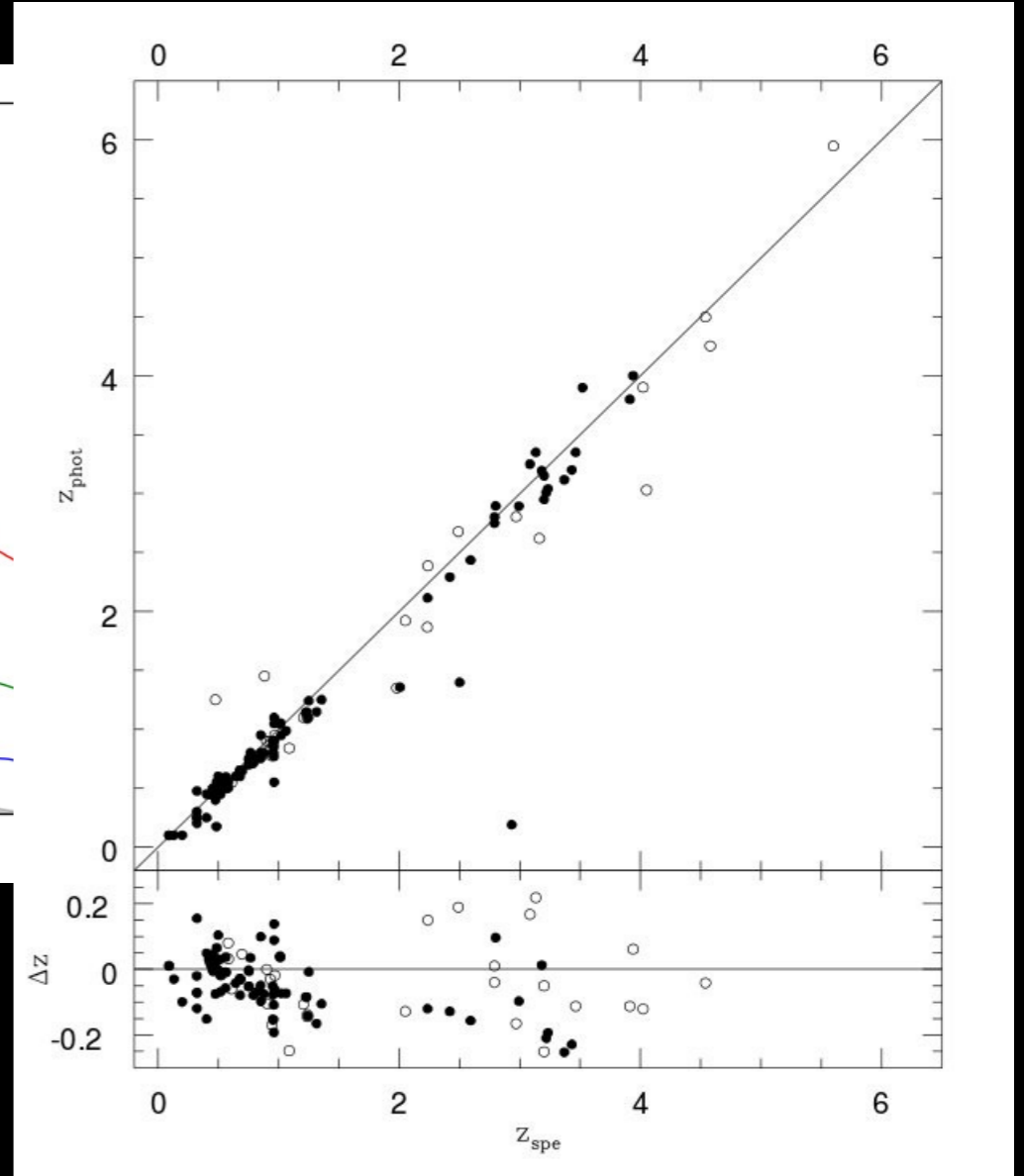
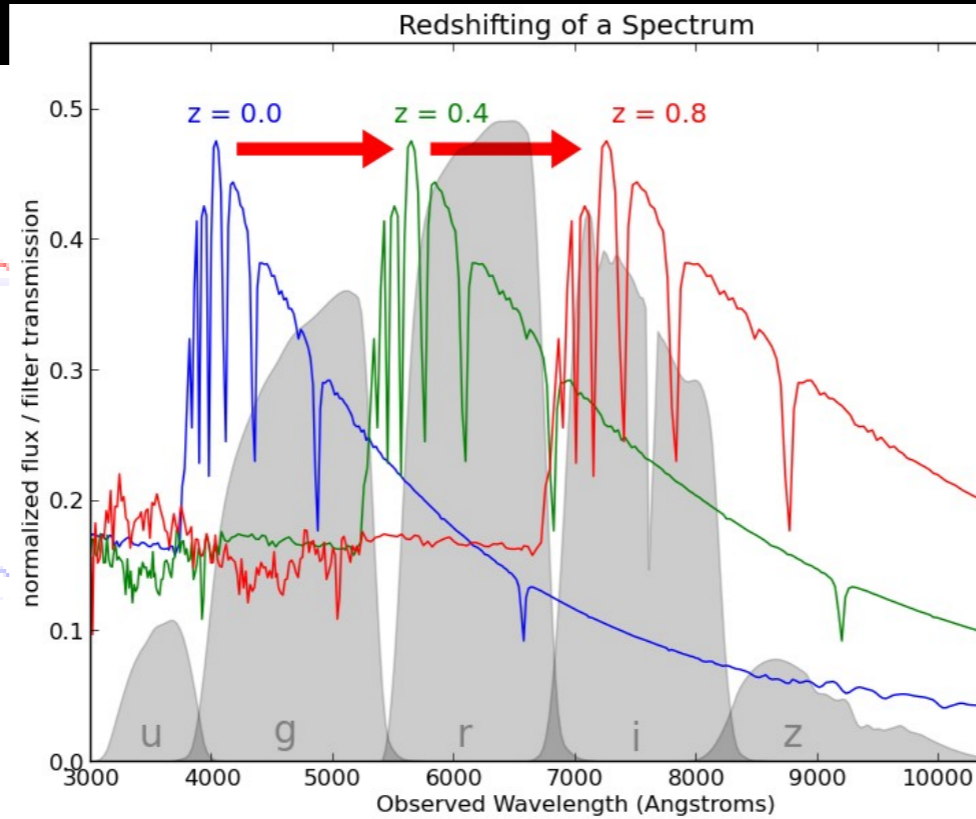
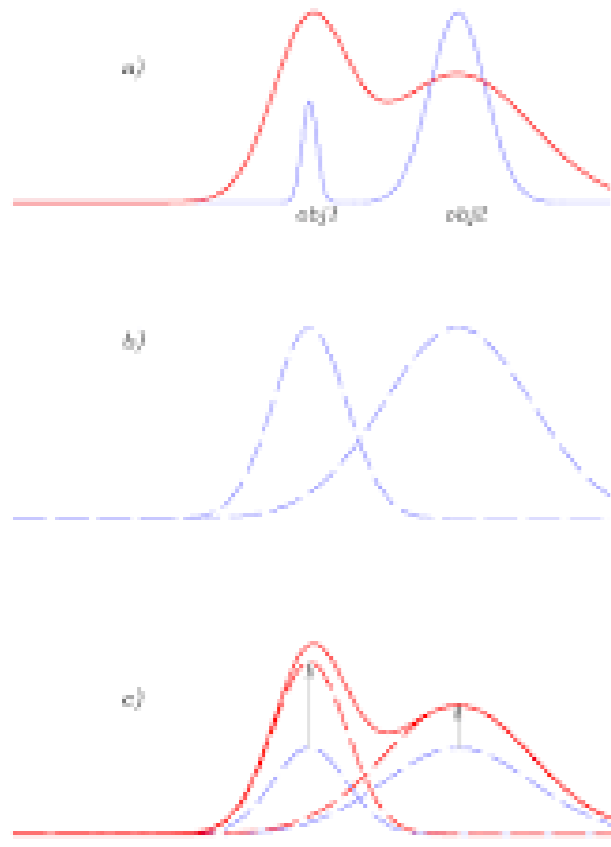
Reionization: when and how ?

Dark Matters: CDM, WDM, Axions or PBHs ?

Mass assembly and LSS: how galaxies form and evolve ?

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Methods: Deep Fields



Multicolor catalogs
T-PHOT Merlin et al. (2015)



ASTRODEEP-OAR
(PI Fontana)
CANDELS+Frontier
Fields Public catalogs

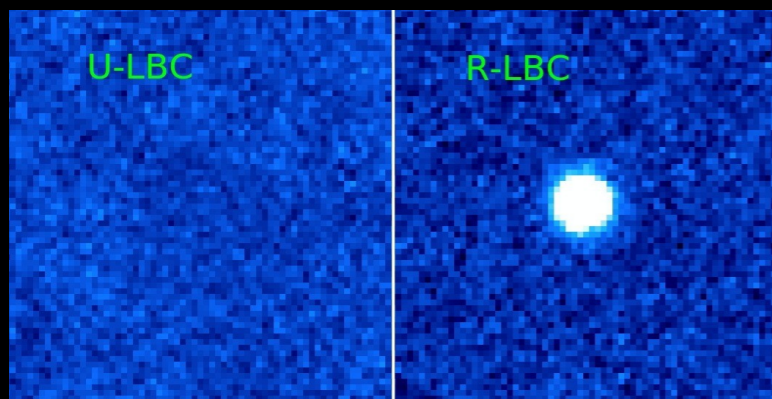
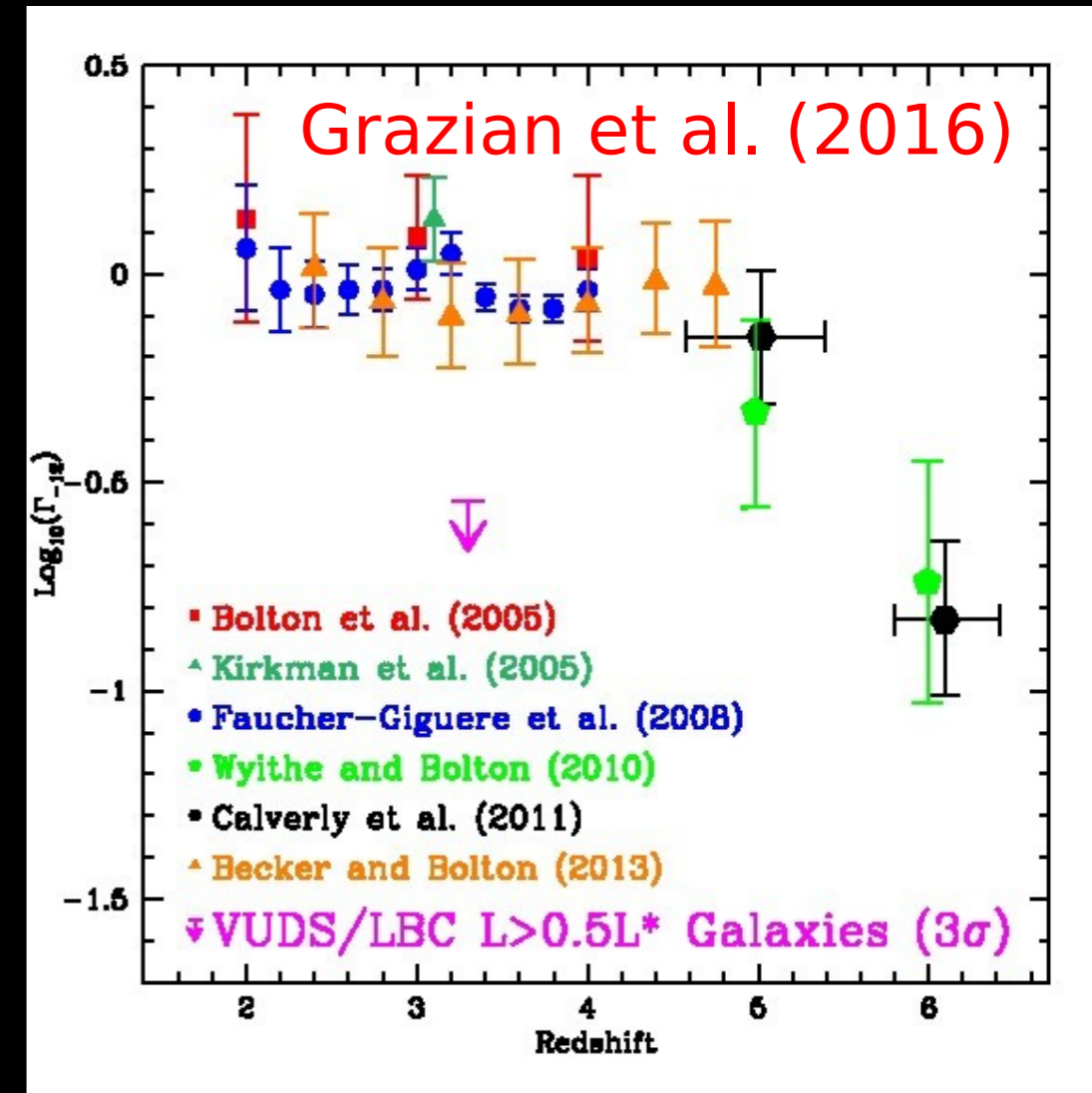
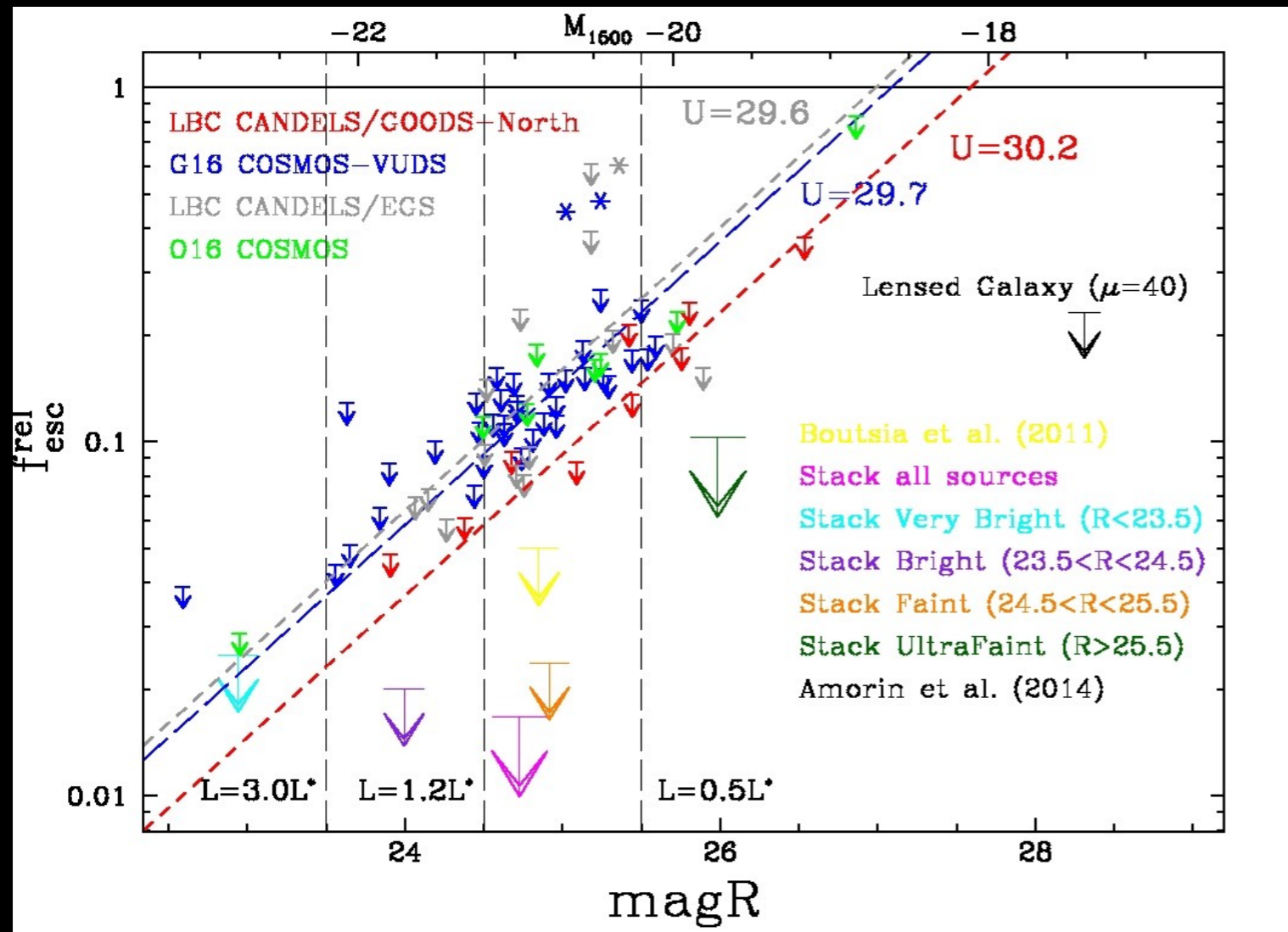
Z_{phot}+Mass
Fontana et al.
(2000); Grazian
et al. (2006)

Open Problems

1. Reionization: LyC Escape fraction of star-forming galaxies at $z > 3$.
2. Luminosity Function of high- z galaxies and AGNs and their contribution to reionization. ([link with Gravitational Lensing](#))
3. Cosmic Dawn and the Universe at $z > 10$. First stars (PopIII). [See Molaro's talk](#)
4. Seeds of SMBHs at $z > 6$: accretion of a stellar BH or direct collapse ?
5. Dark Matters: deep HST observations can constrain Fundamental Physics; stringent limits to mass of WDM by deep galaxy counts (Menci et al. 2016).
6. Primordial BHs as Dark Matter ? ([link with GWs](#))
7. Galaxy assembly: Luminosity Function and Mass Function of high- z galaxies ([link with stellar evolution](#))
8. Red & Dead galaxies at high- z
9. Variable IMF ? Nebular emission ? Influence on physical parameter estimation from SED fitting. [See Eros Vanzella's talk](#)
10. Quenching of Star formation: AGN outflow or strangulation ? ([link with semi-analytical models](#))

And many more.....

LyC Escape Fraction of $z \sim 3$ Galaxies

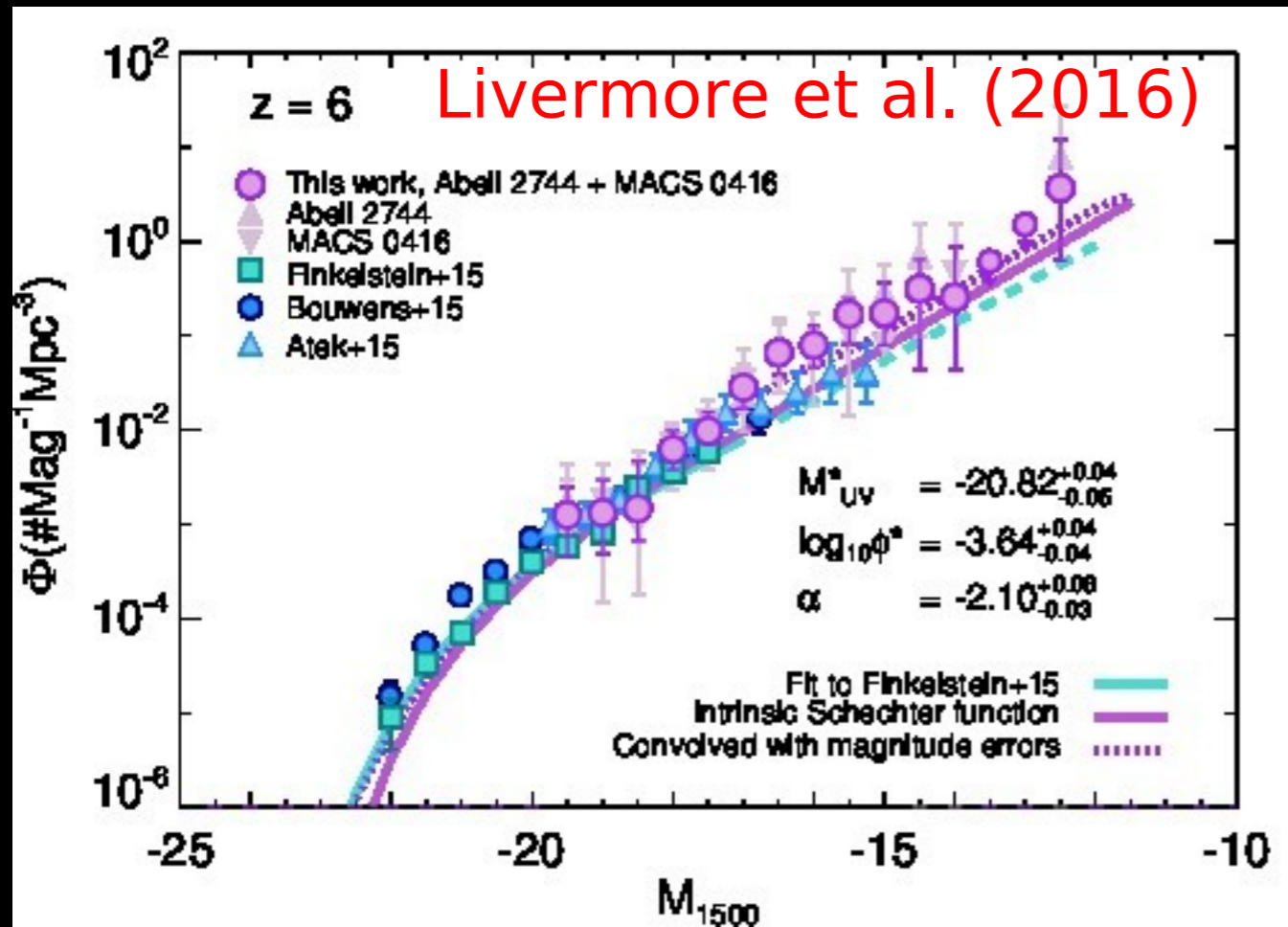


LyC $f_{esc_rel} < 1.7\%$ (1
 sigma) at $z=3.3$ for
 $R < 26.5$

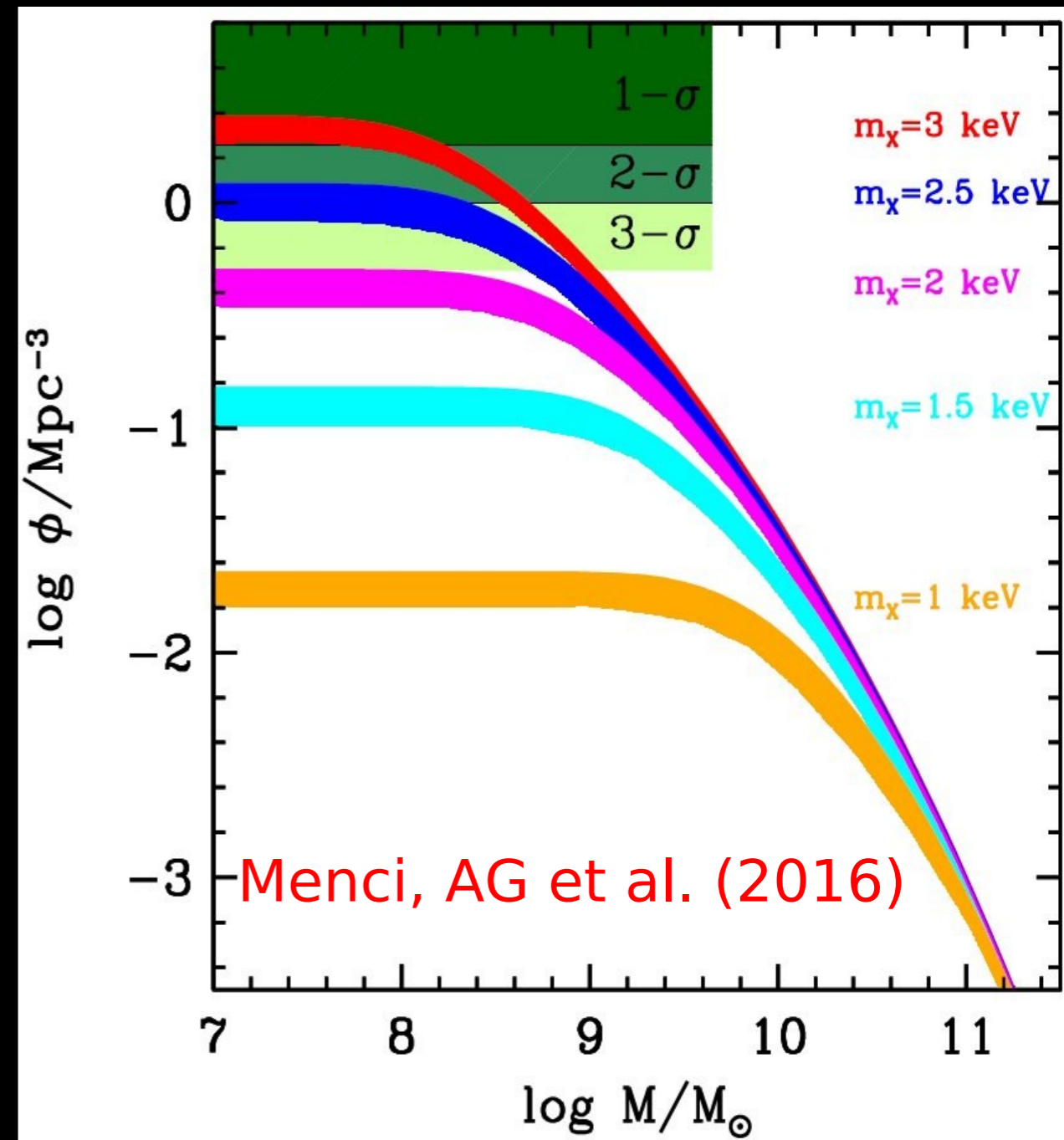
HI Photoionization rate UVB
 Is not produced by bright
 galaxies ($L > 0.5L^*$) at $z \sim 3$

Important to find indirect tracers of "LyC
 emitter analogs" at $z > 6$
 Where direct measures are not possible
 (see talk by Eros Vanzella)

Limits on the Warm Dark Matter particle mass from galaxy abundance

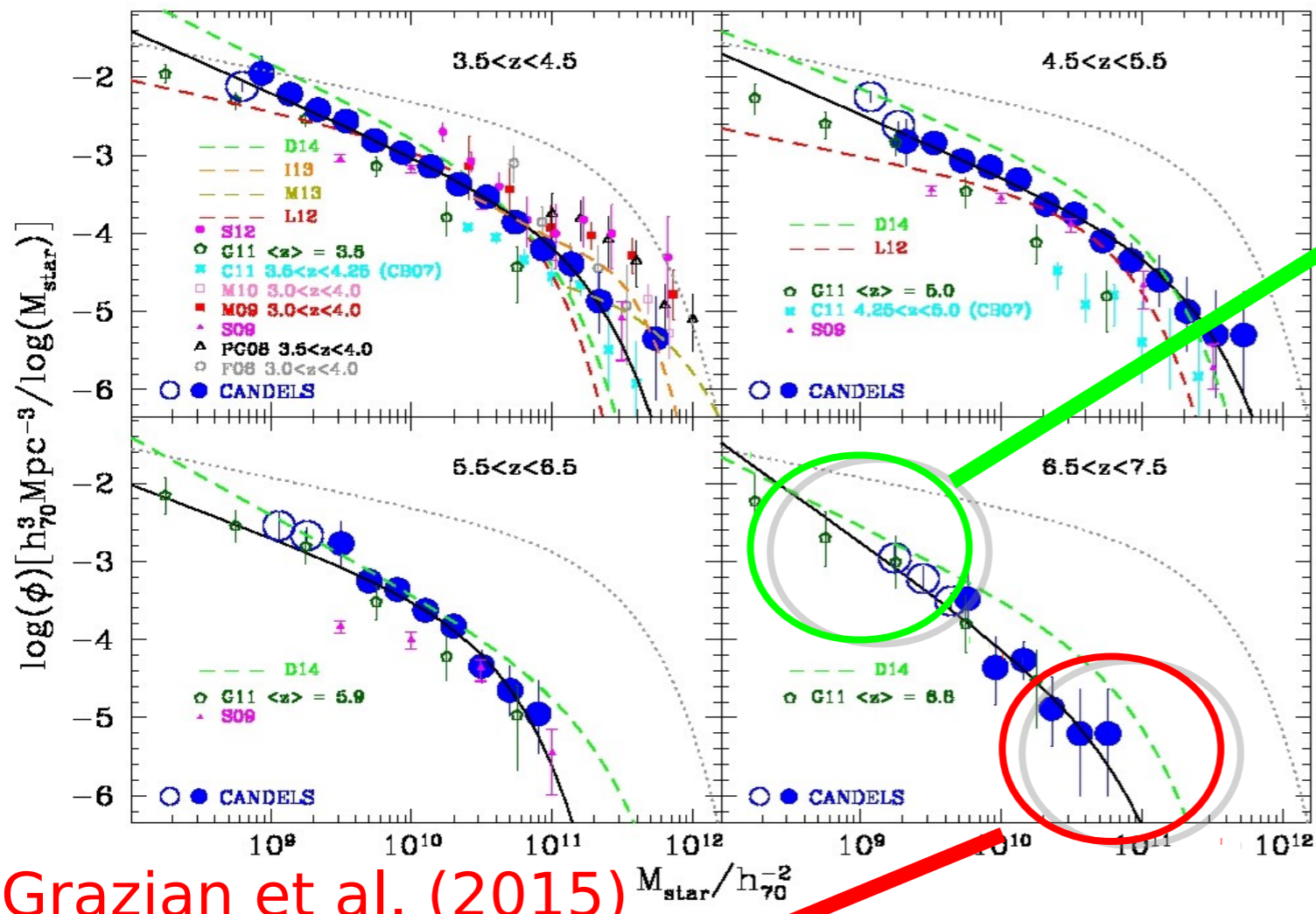


mass_X > 2.9 keV
Independent of
baryonic physics



Deep Fields can be used
to put constraints on
Fundamental Physics

Galaxy Mass Assembly at high redshift

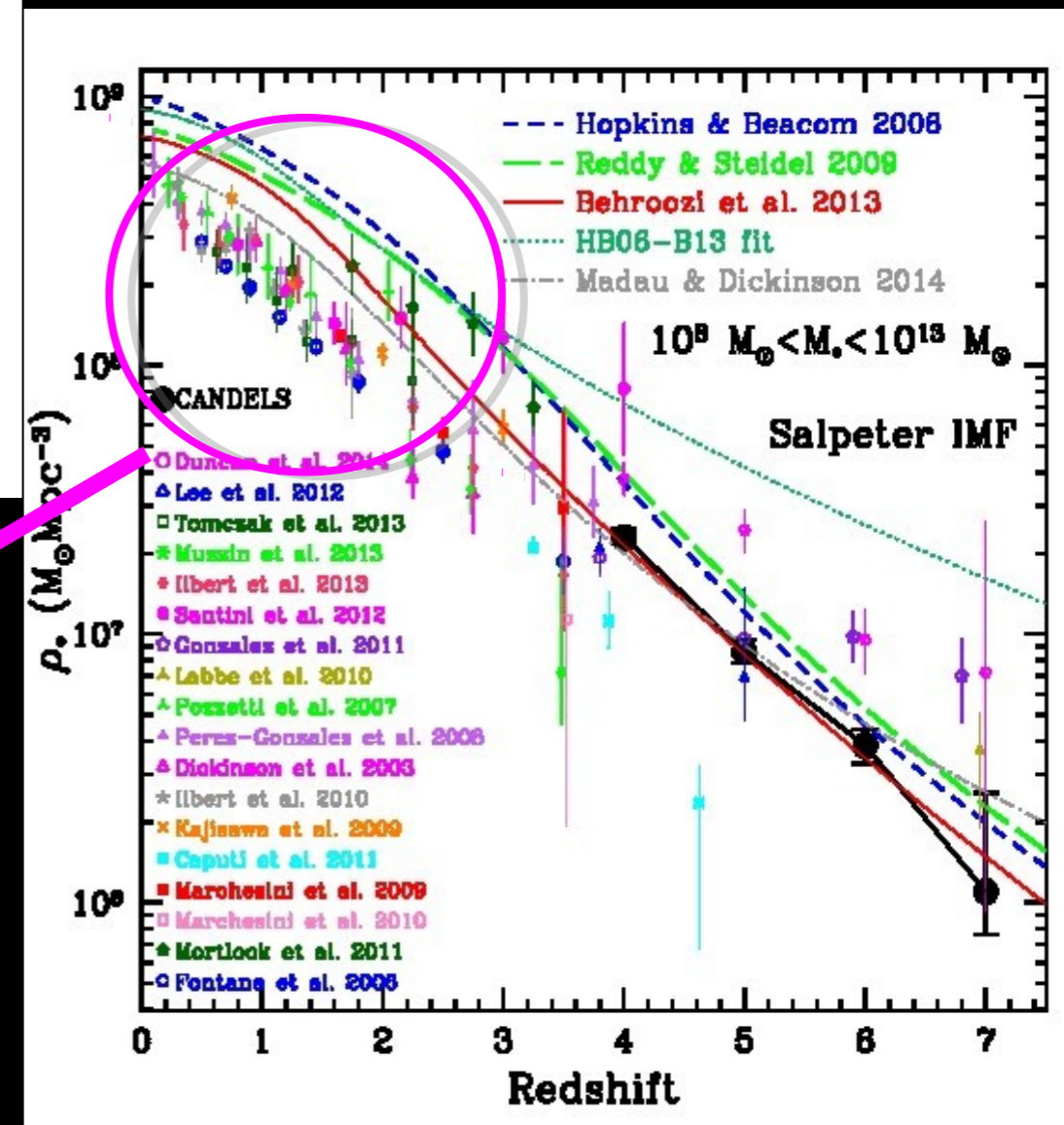


Deep Fields
Are needed to
probe the low
mass end of
GSMF at high-z

Grazian et al. (2015)

Red&Dead
galaxies at
high-z

SFR and stellar
mass do not
agree: IMF ?



Current Big Facilities

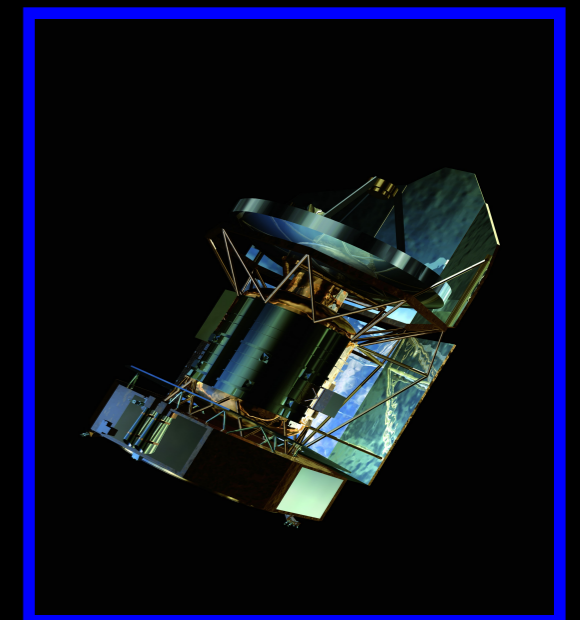
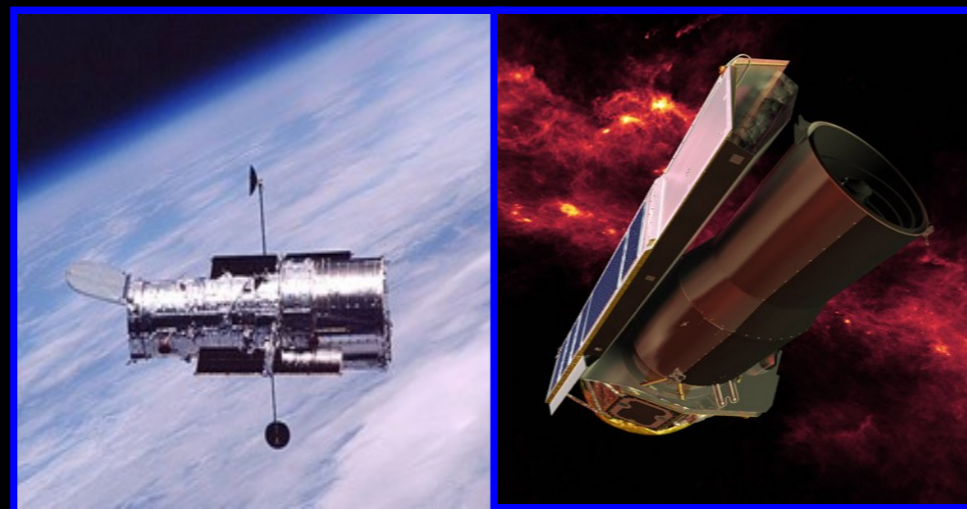
1. Ground-based

- VLT
- LBT
- ALMA
- Subaru
- Keck

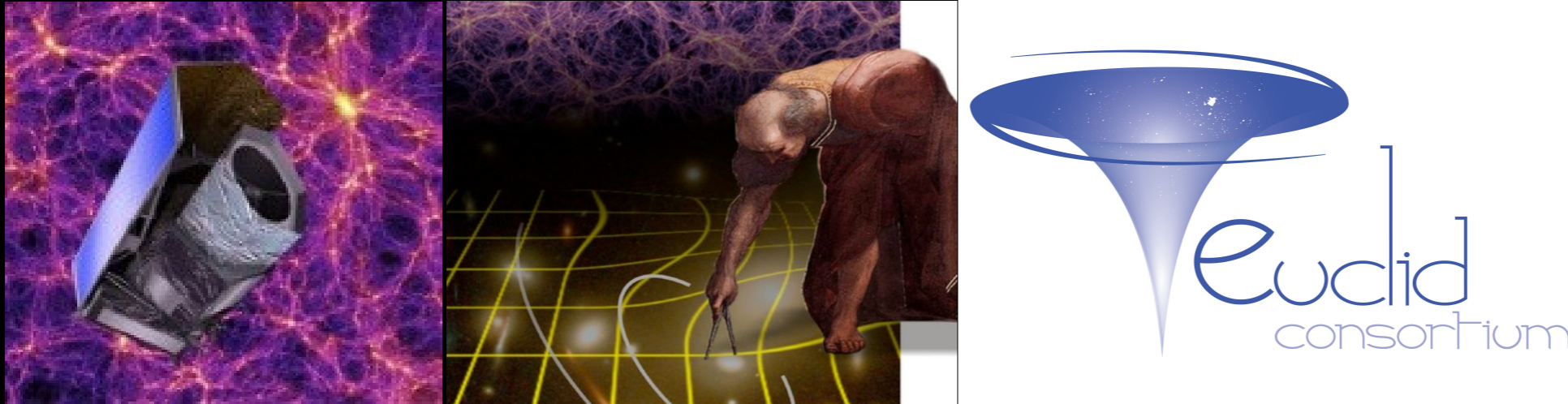


2. Space-based

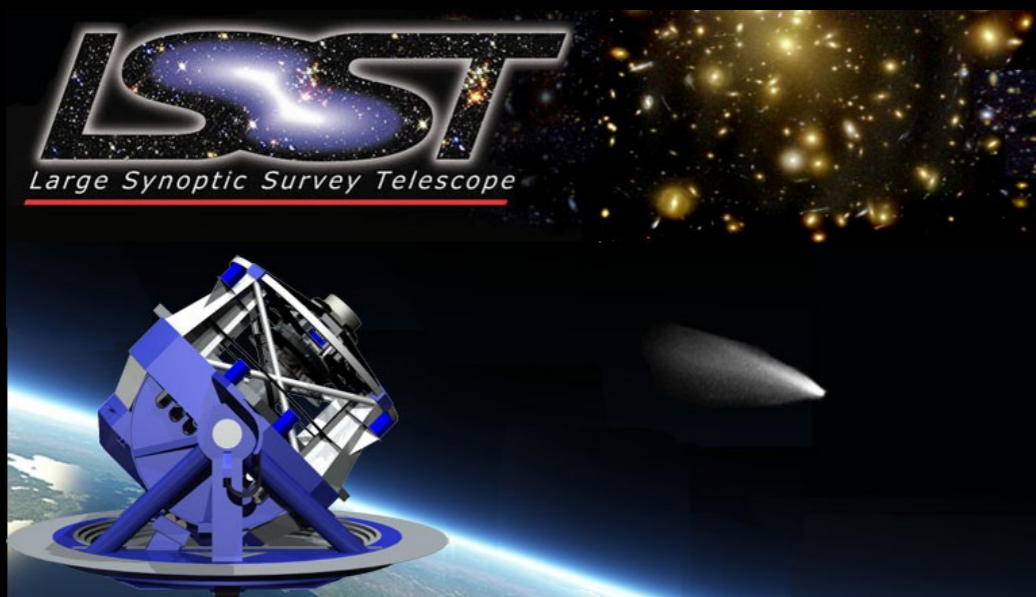
- HST
- Spitzer
- Herschel
- XMM
- Chandra



Future Instruments for Wide Surveys



Euclid



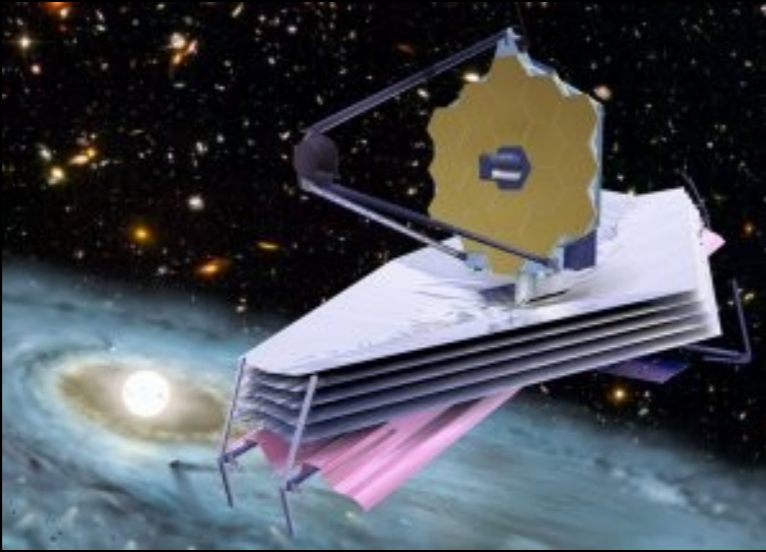
LSST



WFIRST

Future Instruments for detailed observations

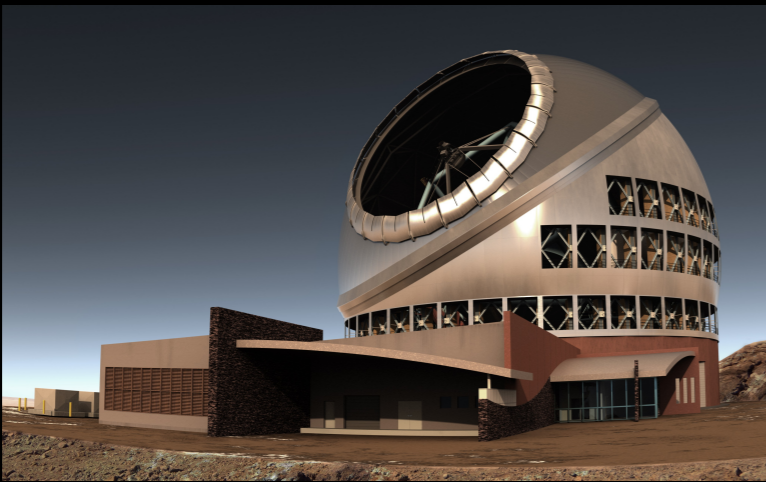
JWST



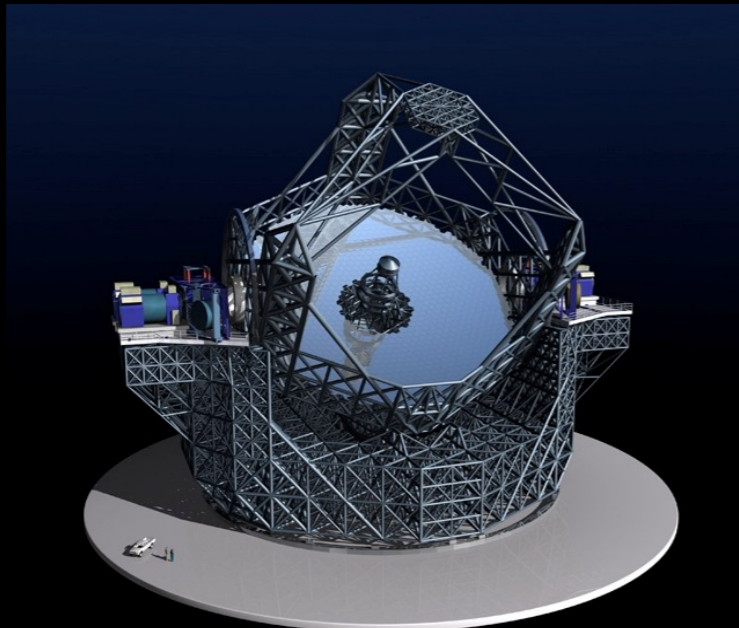
SKA



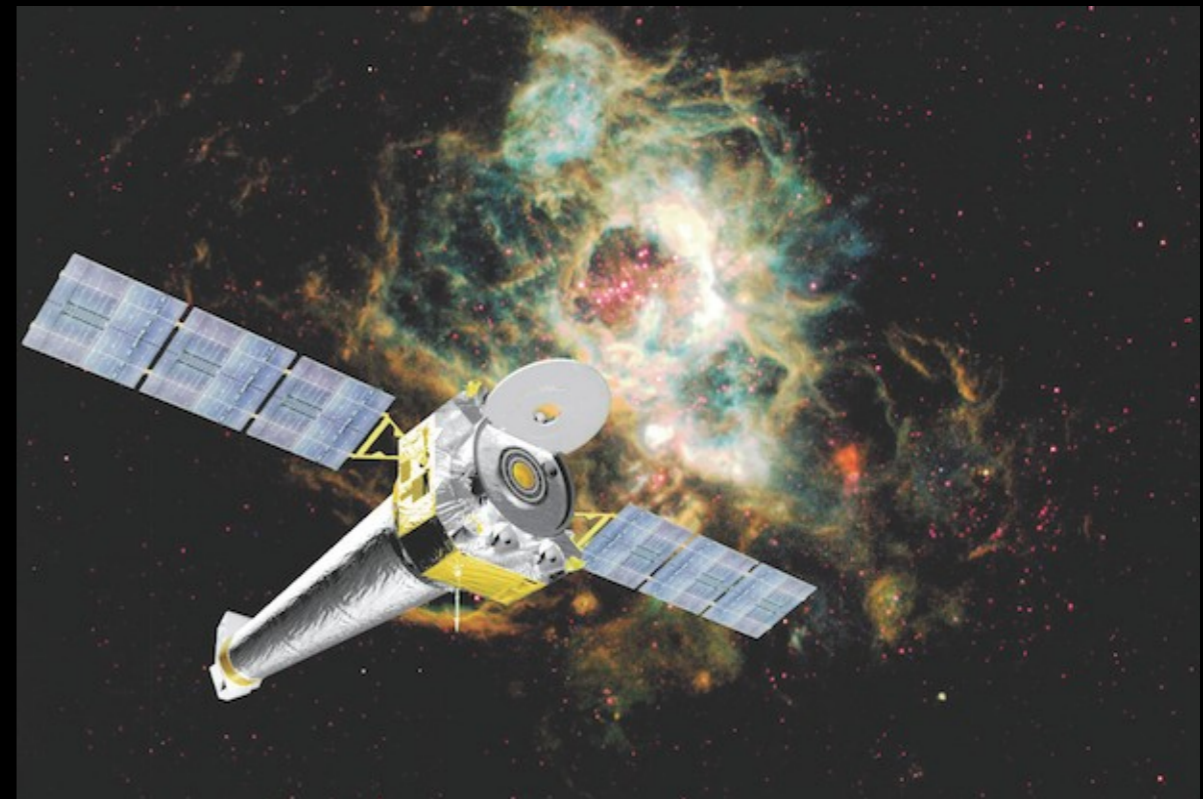
TMT



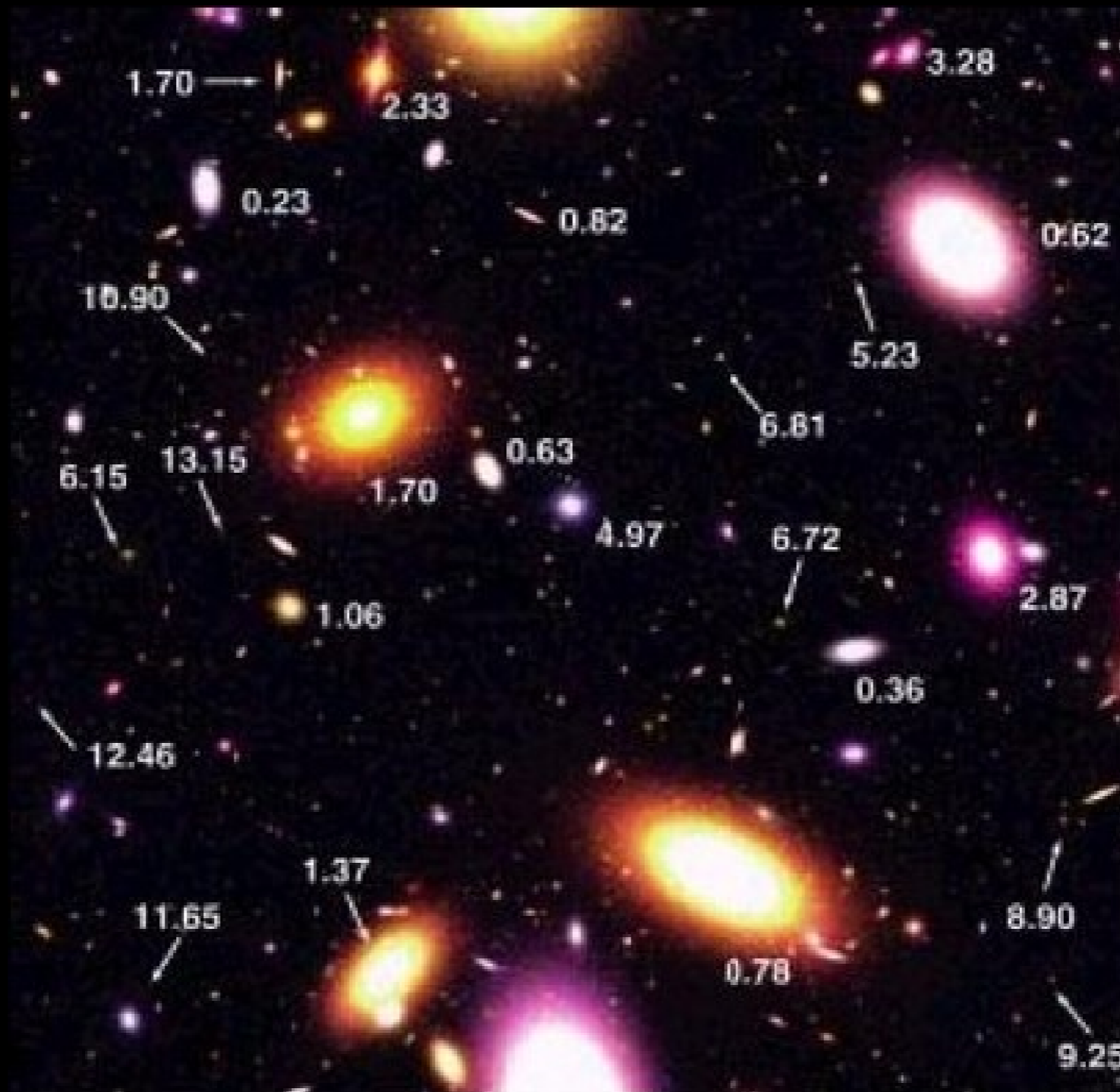
E-ELT



Athena



JWST Deep Field Simulation



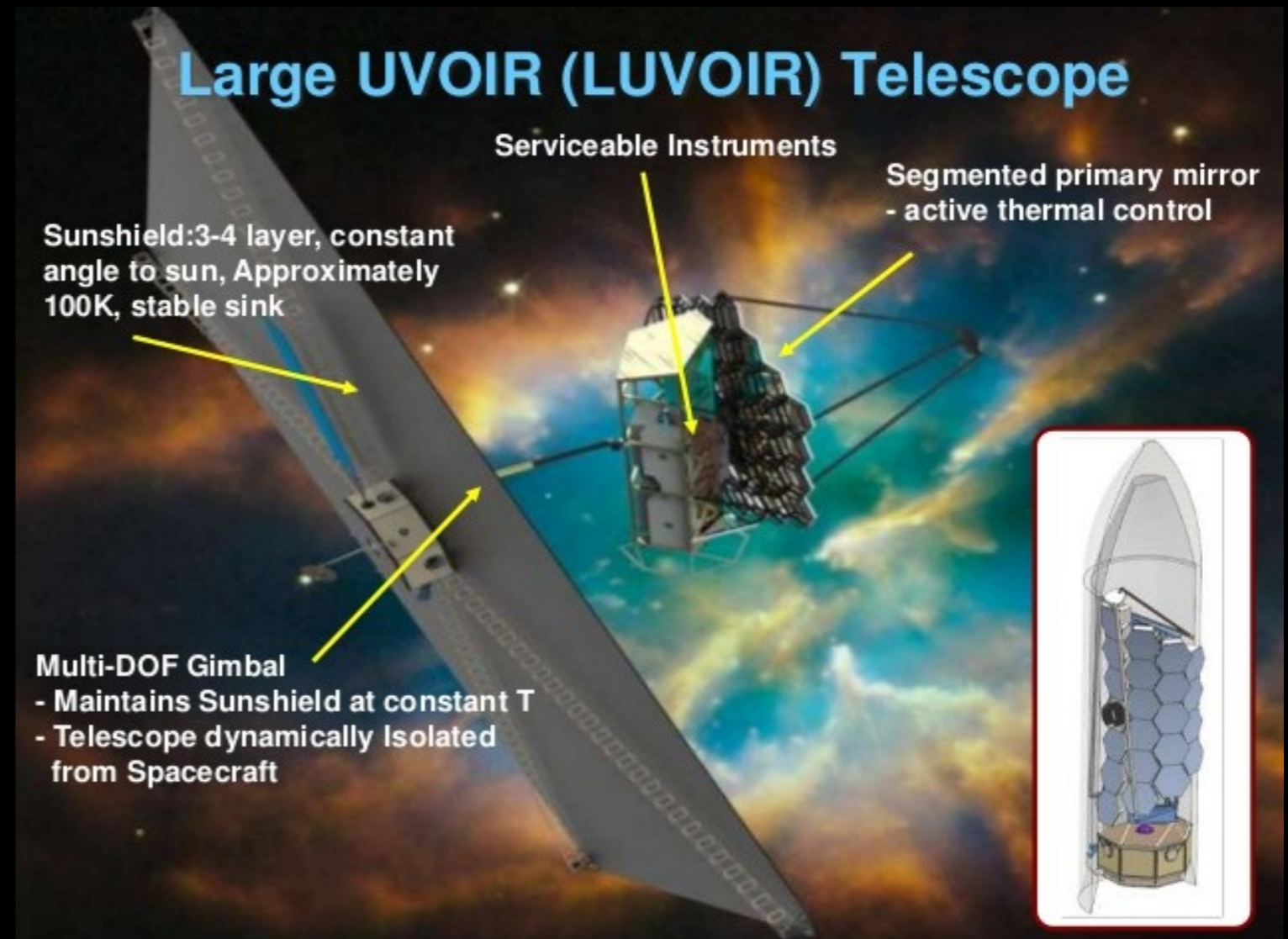
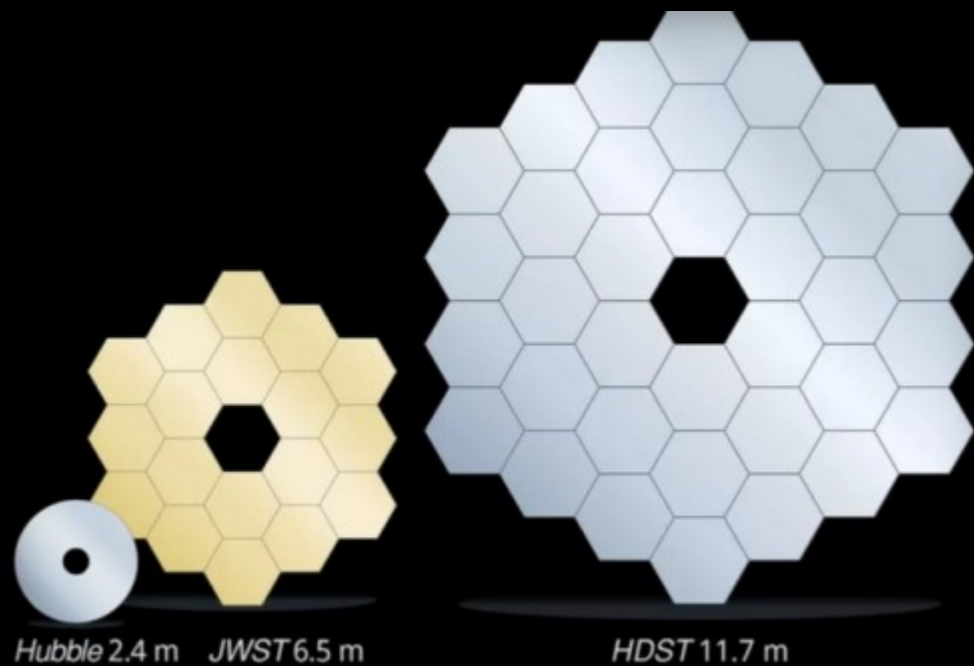
Galaxies at $z \sim 12-15$; only 1% of the JWST field of view

TRANSFORMATIONAL SCIENCE (complemented by spectroscopy)

But after HST, no UV window from space!!!

VISIONARY

Beyond JWST: LUVOIR/HDST



“Astronomy compels the soul to look upward
And leads us from this world to another”
Platone, La Repubblica, 390-360 A.C.