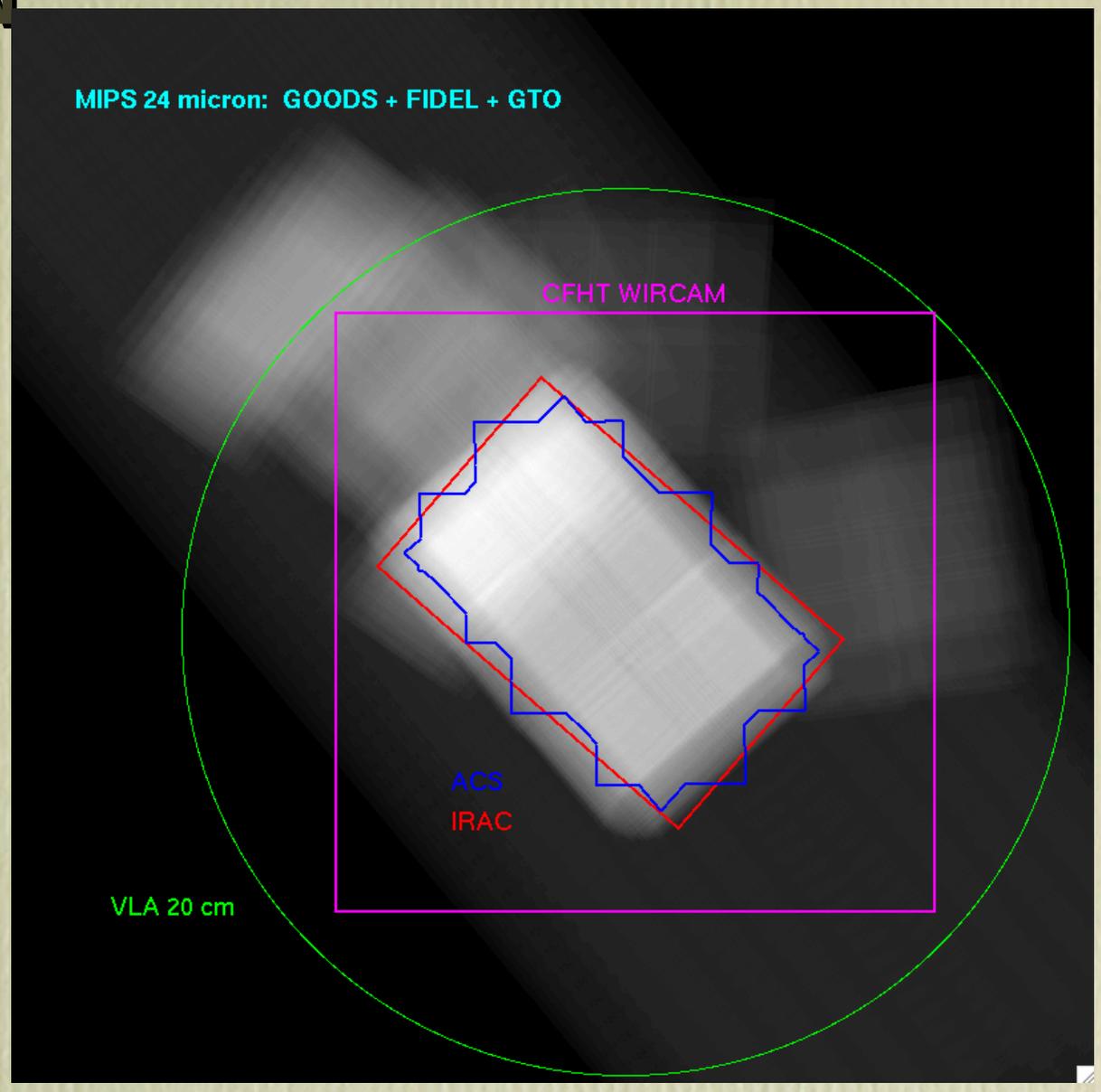
Two Slides from Lihwai Lin

(For AEGIS group meeting in Toledo)

WIRCAM imaging in Extended GOODS-N

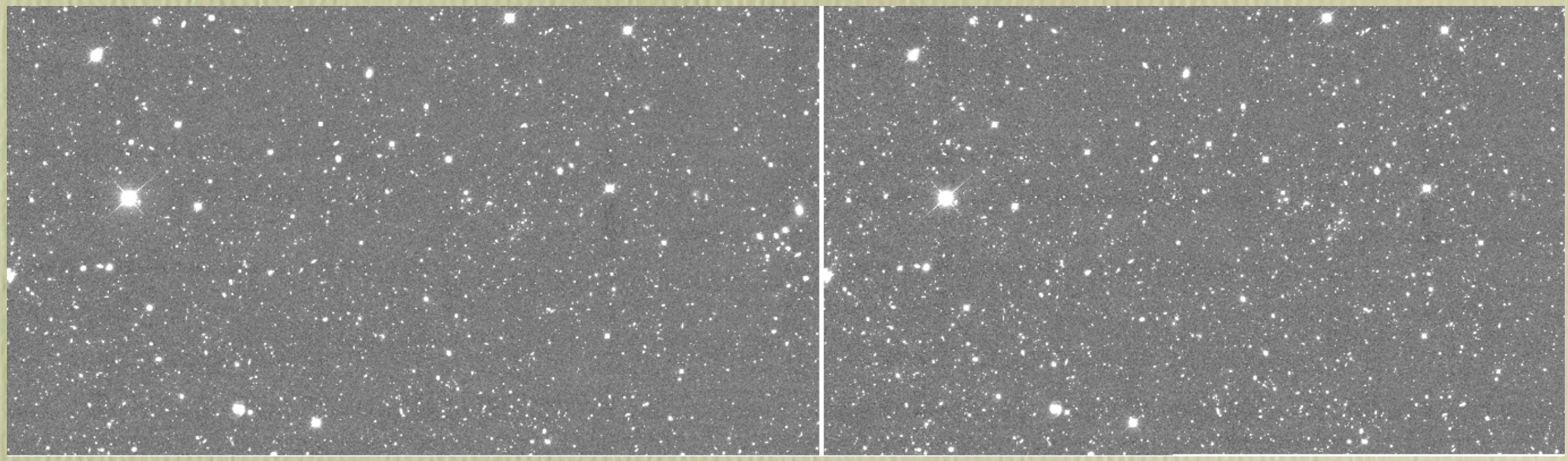
- Joint program between Taiwan, Canada, and US (2006-2009) using CFHT/WIRCAM to image the Extended GOODS-N field
  - Taiwan: 52 hrs in J; Canada: 10 hrs in K, + data taken by the Hawaiian group (Cowie 50 hrs)

- People:
  - Taiwan: Lihwai Lin, Chi-Hung Yan, Yi-wen Chen, S. Wang
  - Canada: Luc Smard, Nicole Meger, Alexandra Pope, Douglas Scott
  - US: Haojing Yan, Mark Dickinson, David Koo, Sandr Faber, Mark Brodwin



28'x 28', 4x the area of ACS GOODS-N

Data Status



- As of Dec. 2009, 80% of the allocated J-band program has been observed and processed.
- Depth of current processed data (AB, 5-sigma, d=2” aperture): J ~ 24.8 (34.3hrs; ~40,000 sources); K ~ 24.2 (43.1hrs; ~48,000 sources)
- The H-band proposal was not successful for two years, and will be resubmitted in 2010
- Stacks and catalogs are available to the AEGIS/SEDS teams through collaborations. Data contact: Lihwai Lin (lihwailin@asiaa.sinica.edu.tw)

Very High-z Universe in the WFC3 Era

Haojing Yan
Center for Cosmology & AstroParticle Physics
Ohio State University

AEGIS Collaboration Meeting
Toledo, December 11, 2009

✓ *"Galaxy Formation in the Reionization Epoch as Hinted by WFC3 Observations of the HUDF"* **(submitted to ApJ; arXiv:0910.0077)**

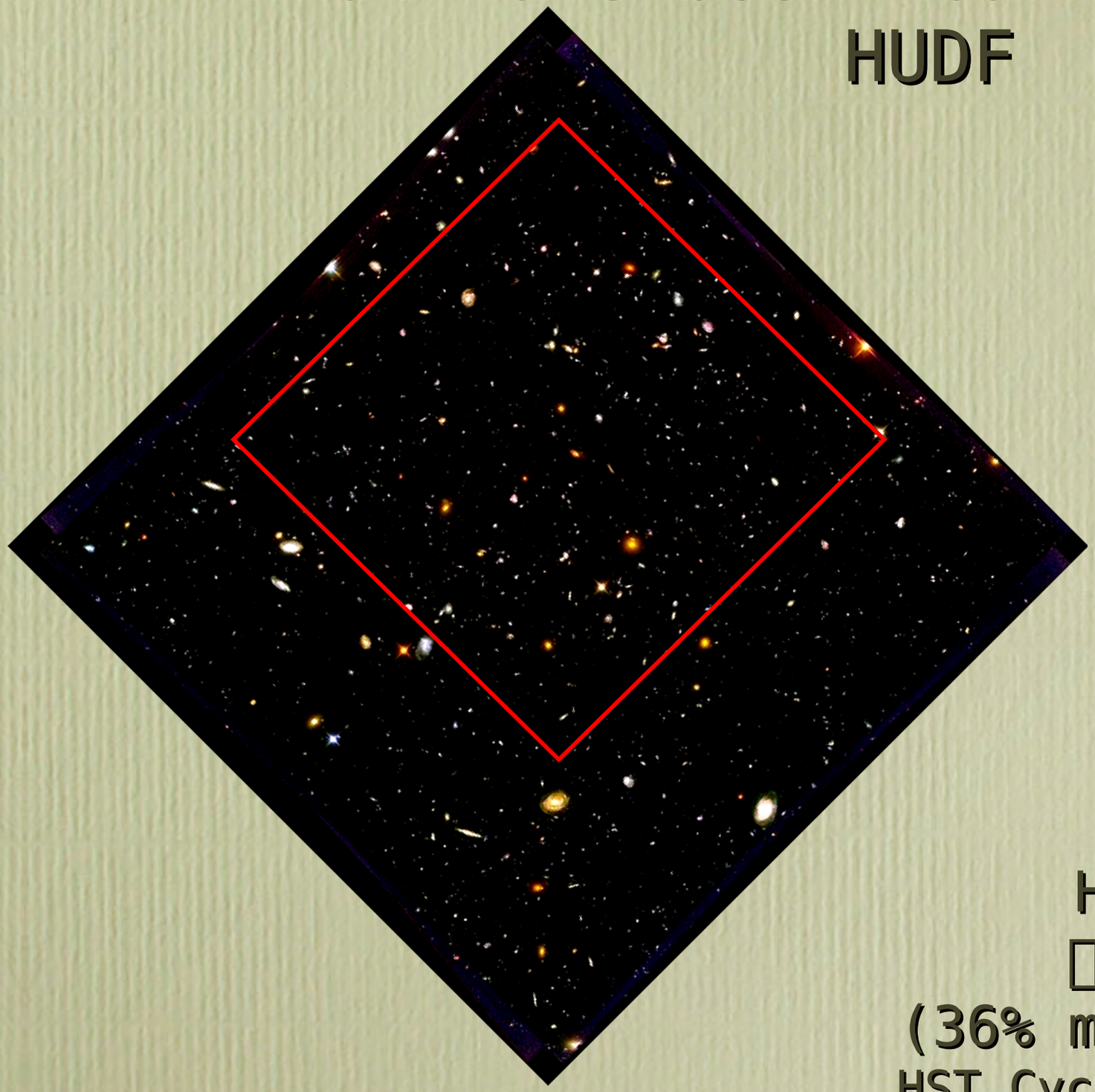
✓ *"Galaxies at Very High Redshifts from the ERS Program of the WFC3 SOC"* **(to be submitted to ApJ)**

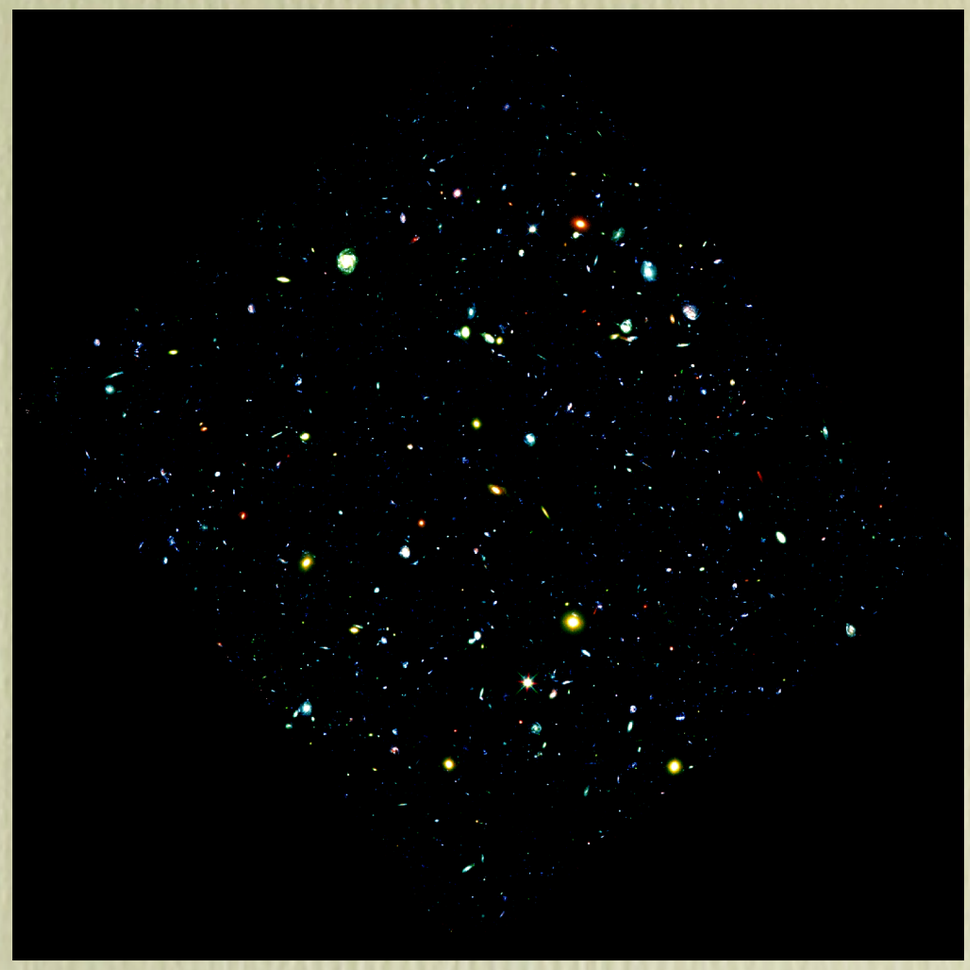
- **Collaborators:**

Rogier Windhorst (*Arizona State University*)
Nimish Hathi (*UC Riverside*)
Seth Cohen (*Arizona State University*)
Russell Ryan (*UC Davis*)
Robert O'Connell (*University of Virginia*)
Patrick McCarthy (*Carnegie Observatories*)

& WFC3 SOC Team

What have been learned from WFC3 HUDF





HUDF WFC3, □ 4.7 arcmin²
□ 29 mag from 0.9–1.7μm
(36% more data to come next ye
HST Cycle-17 GO 11563, PI: G. Illigw

HUDF ACS, □ 11 arcmin²
□ 30-31 mag from 0.4–0.9μm

WFC3 HUDF: Consensus & Disagreement

- **Oesch et al. (0909.1806), Bouwens et al. (0909.1803), Bunker et al. (0909.2255), McLure et al. (0909.2437):** smooth transition of decreasing number density of galaxies at higher redshifts (dimmer M* *and* lower @*); SFR density keeps decreasing to z~8

- But more active star-forming activities (reads: more star-forming galaxies) at higher redshifts are needed to explain: Reionization & “Matured”, high-mass galaxies observed at z~6, 5

- **Yan et al. (0910:0077):** same trend until z~7, but hint of rising SFRD (dramatic decrease of M* but huge increase of □*) starting z~8; could naturally explain

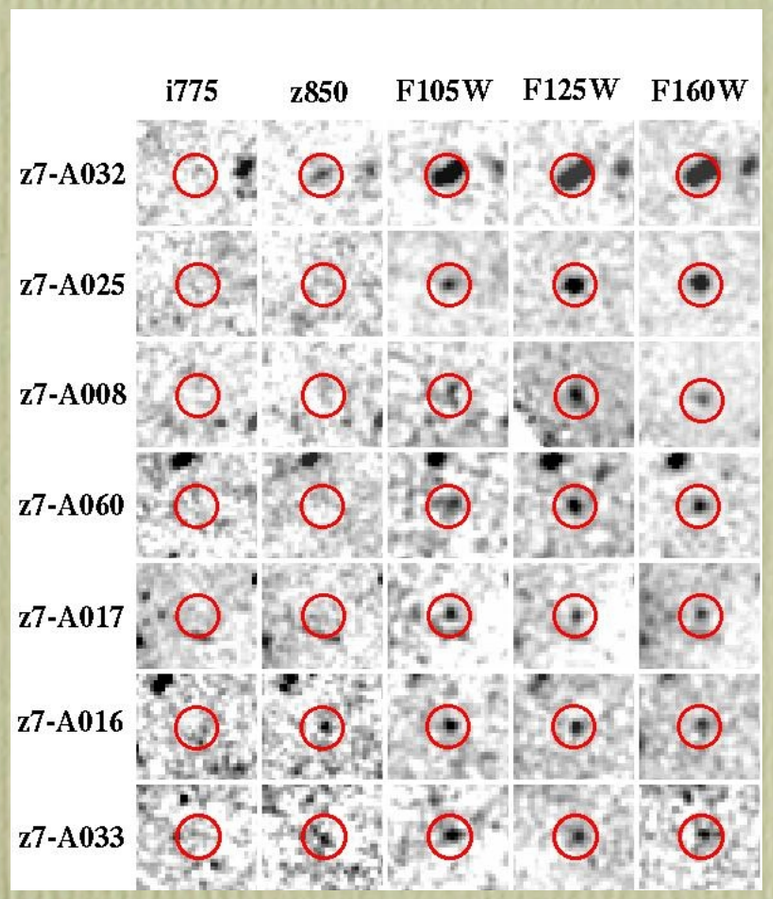
WFC3 HUDF: Consensus & Disagreement

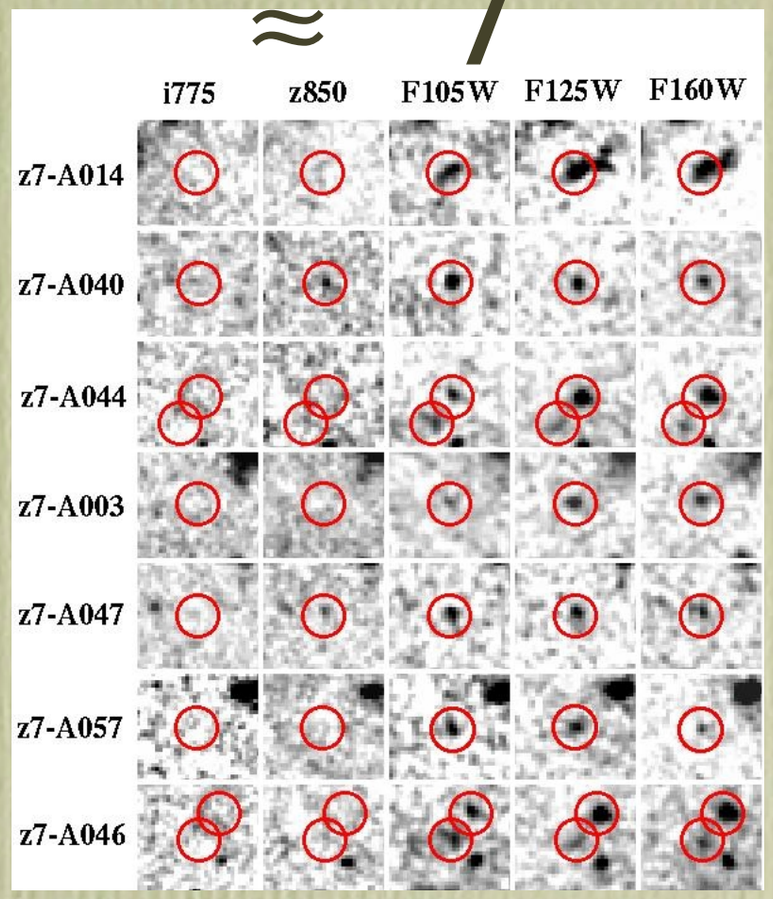
- **Yan et al. (0910.0077), Labbe et al. (0910.0838):** most massive LBGs at z~7 selected as dropouts have stellar masses only to the order of $10^9 M_{sun}$ (or barely $10^{10} M_{sun}$)

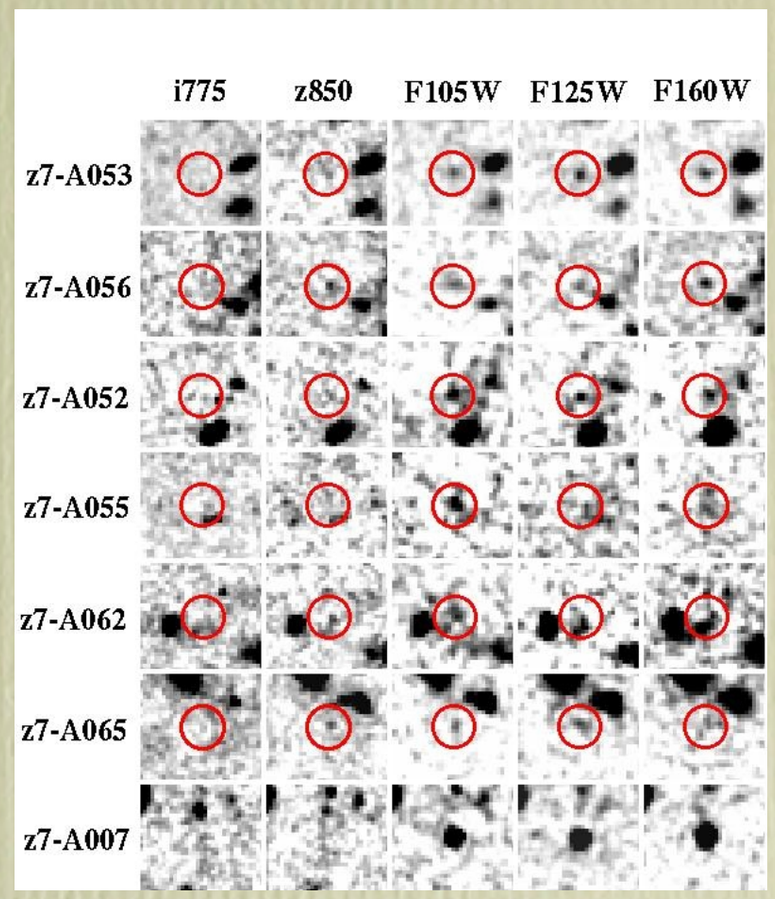
- **Bouwens et al. (0909.1803), Bunker et al. (0909.2255), Yan et al. (0910.0077):**

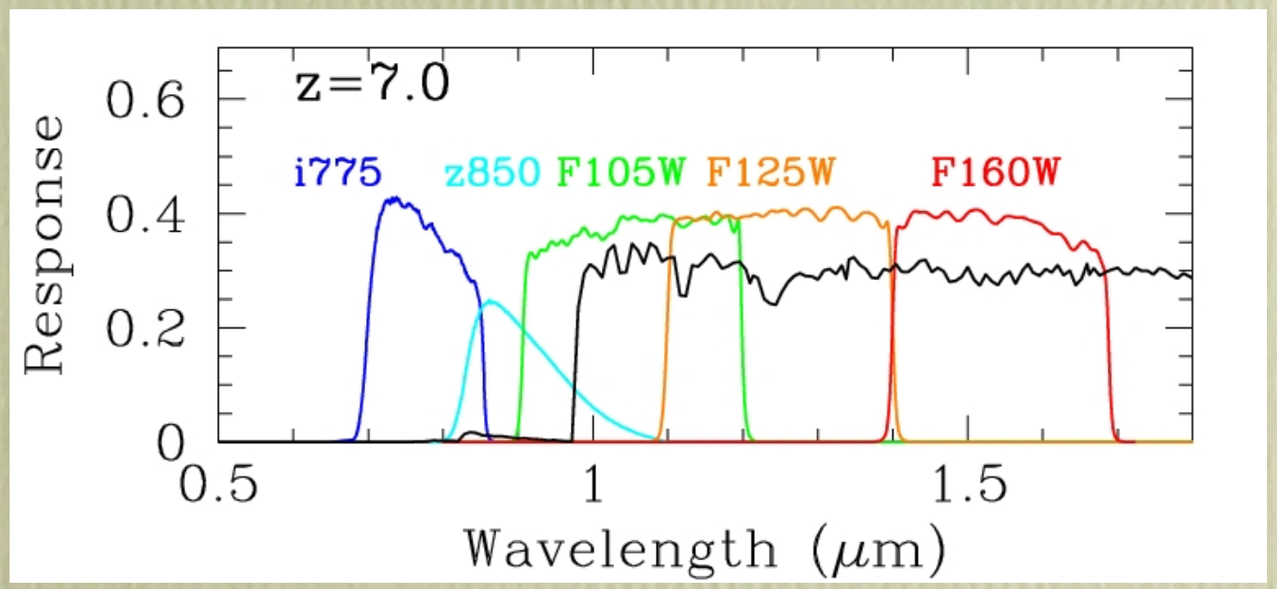
  some of the candidates have very blue restframe UV slopes $\beta<-2.0$ ($f_\lambda \propto \lambda^{\beta+2}$) (roughly, J-H<-0.5) that are difficult to explain by “normal” population synthesis models (age, metallicity, IMF)

20 Galaxy Candidates at z ≈ 7

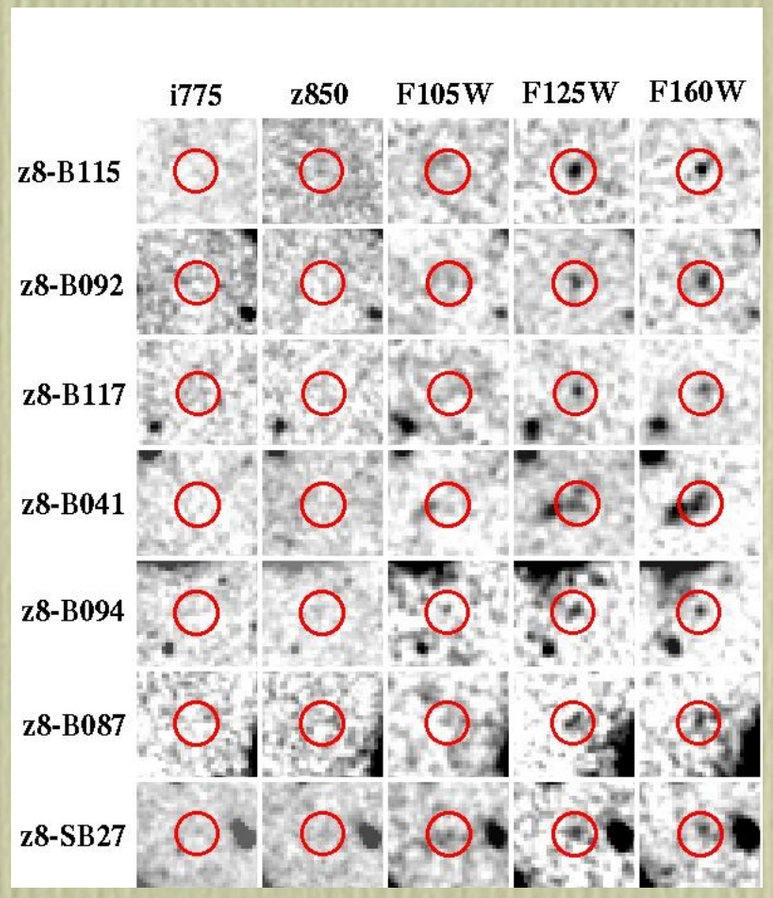


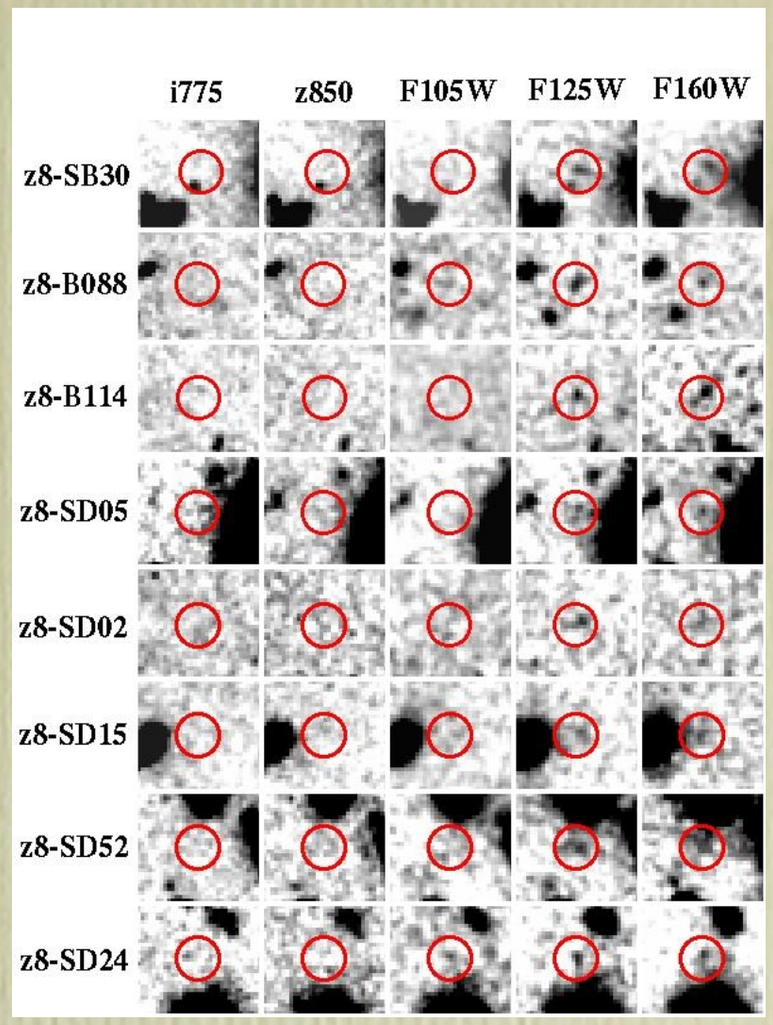


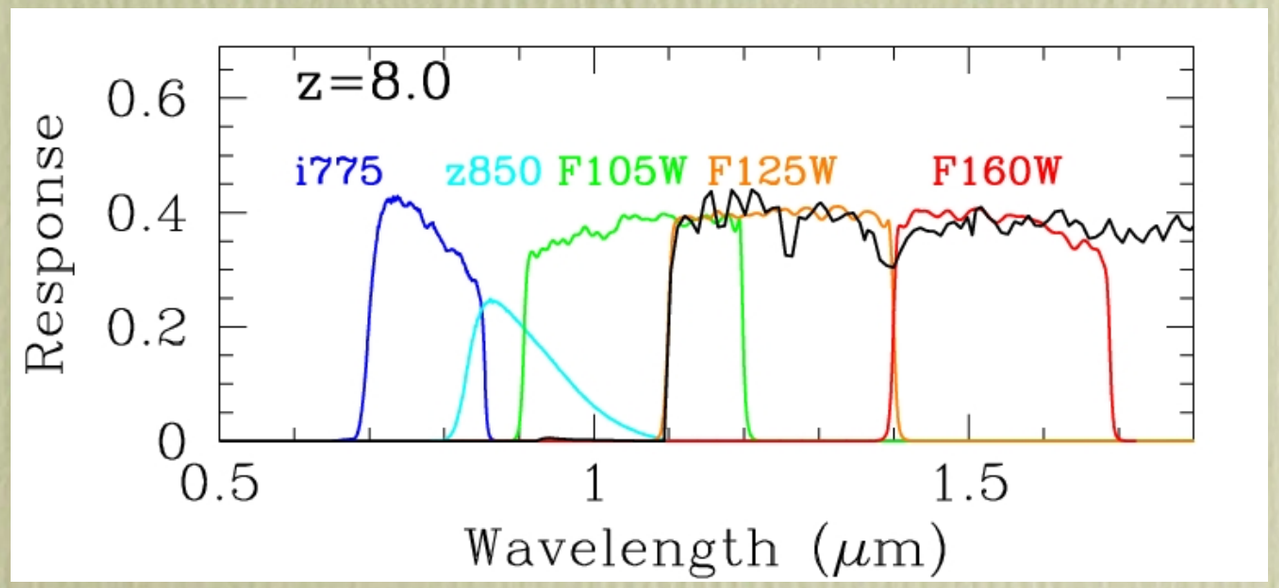




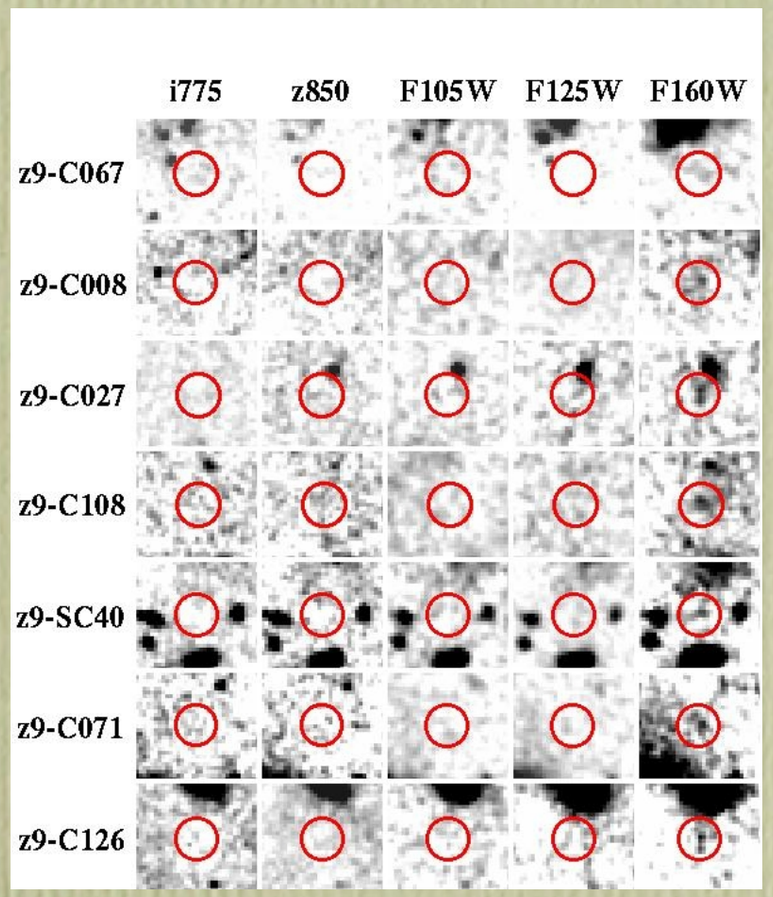
15 Galaxy Candidates at z ≈ 8

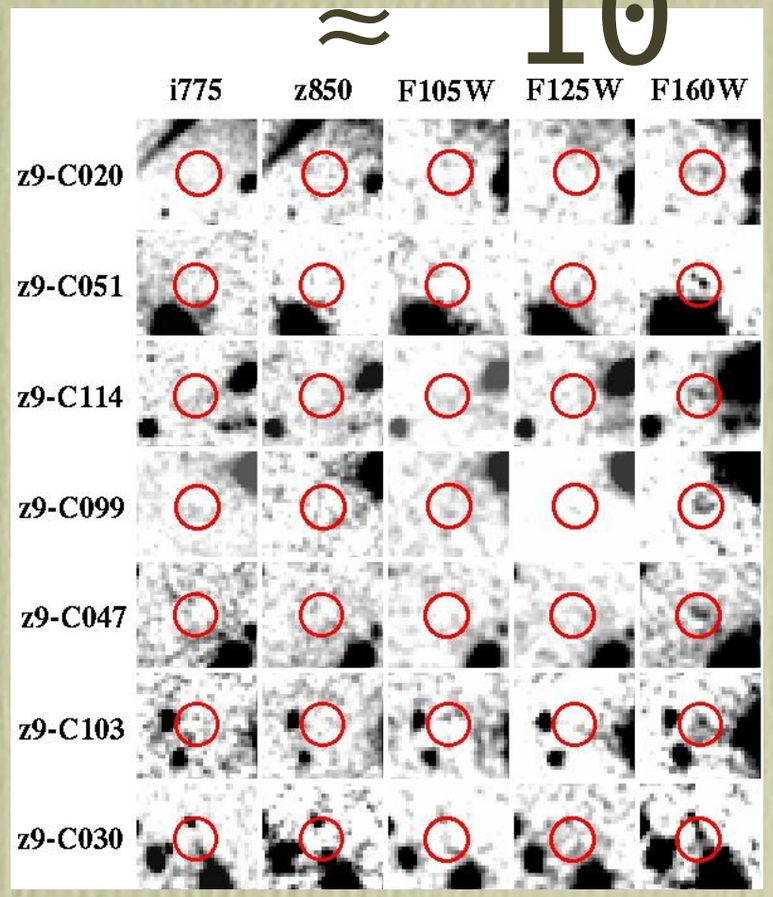


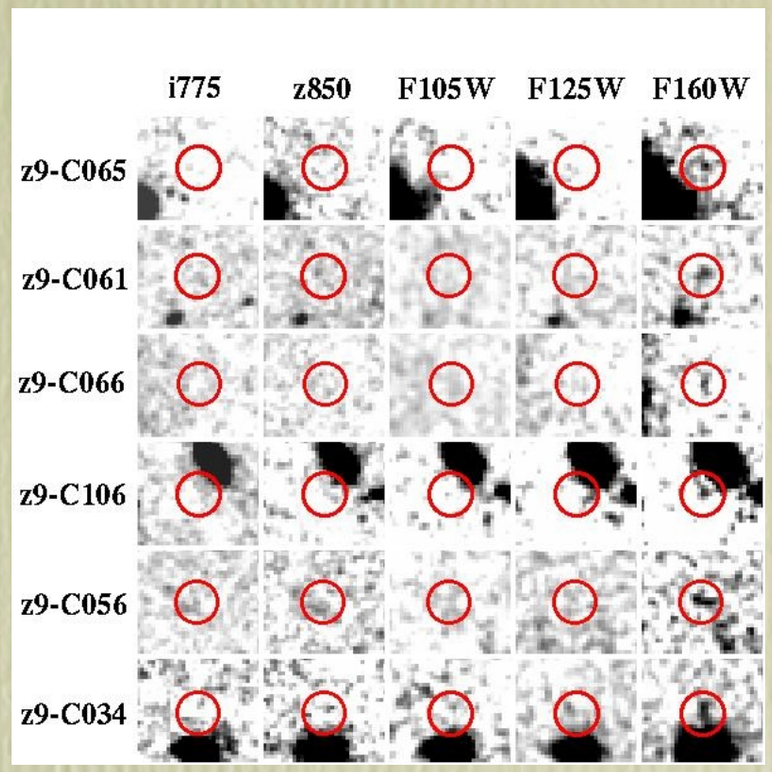


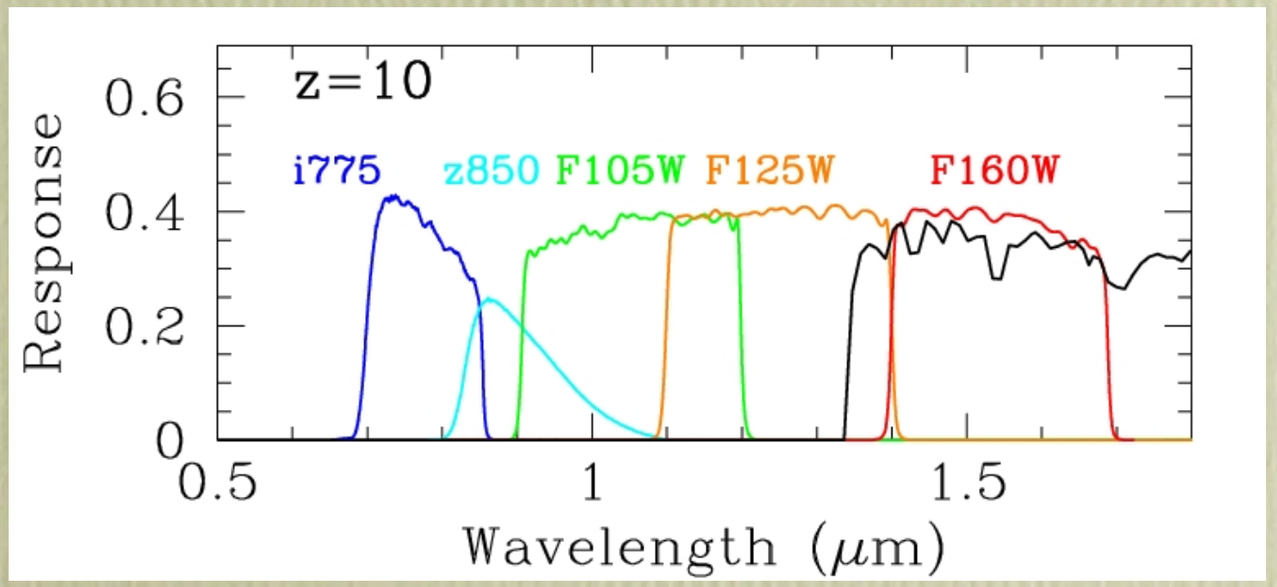


20 Galaxy Candidates at z ≈ 10









LF & GSFRD at Very High-z

Cumulative Surface Density

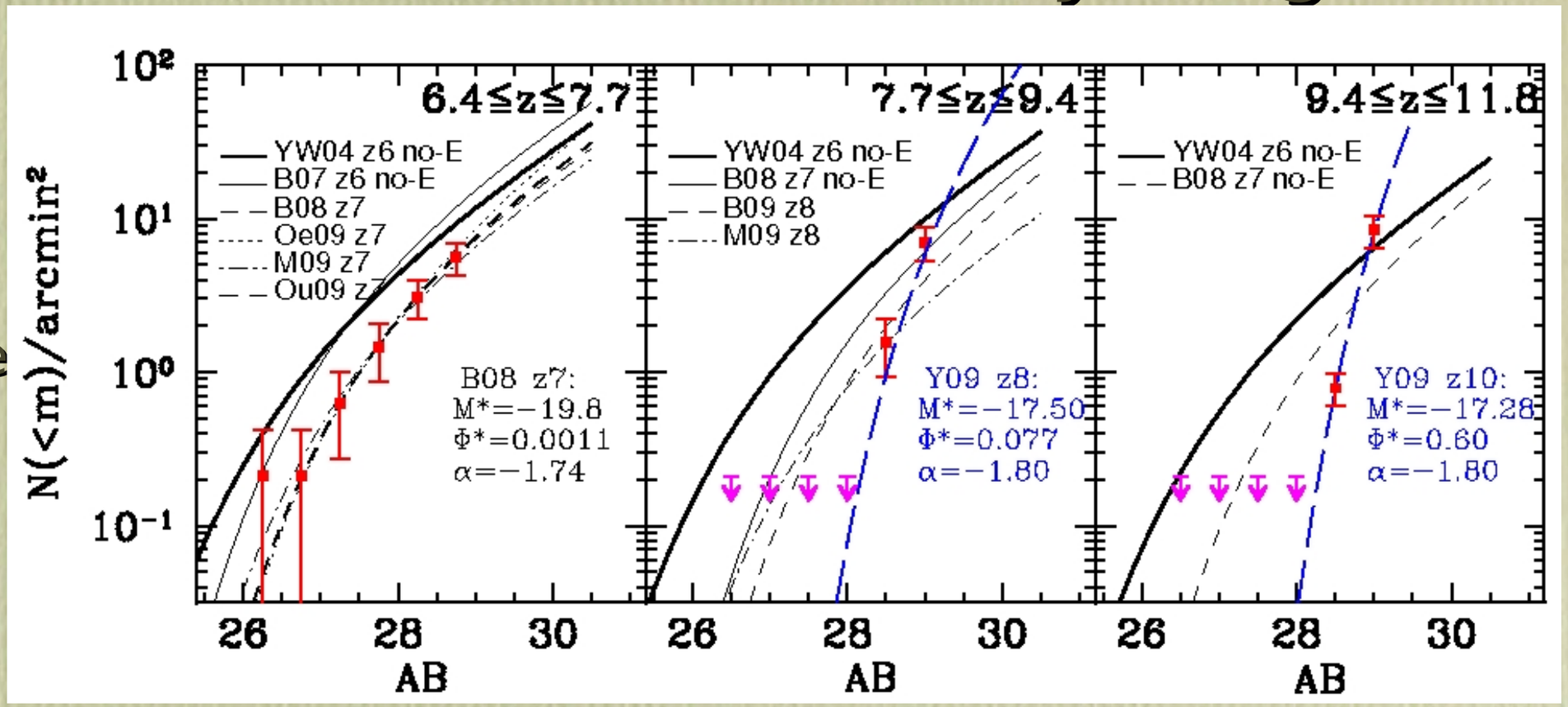
L_{UV}

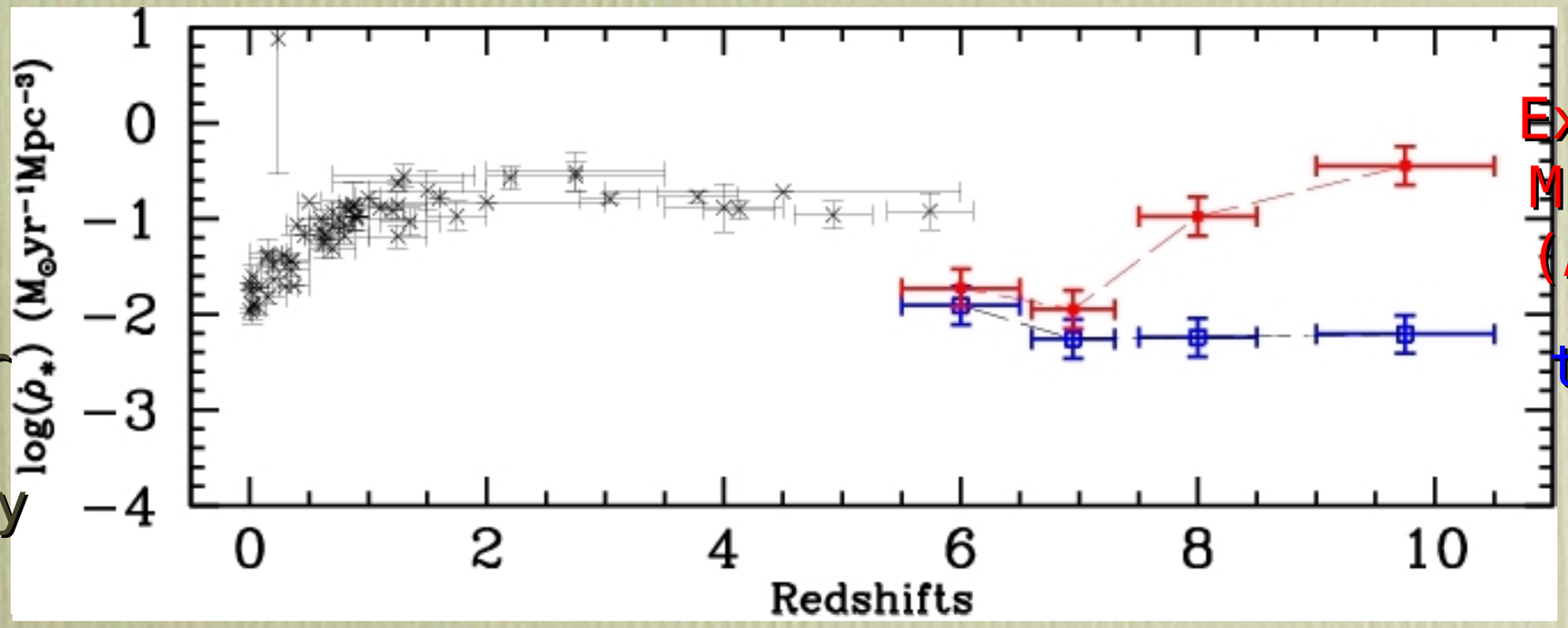
⬇

SFR ⊗ Volume

⬇

Global Star Formation Rate Density



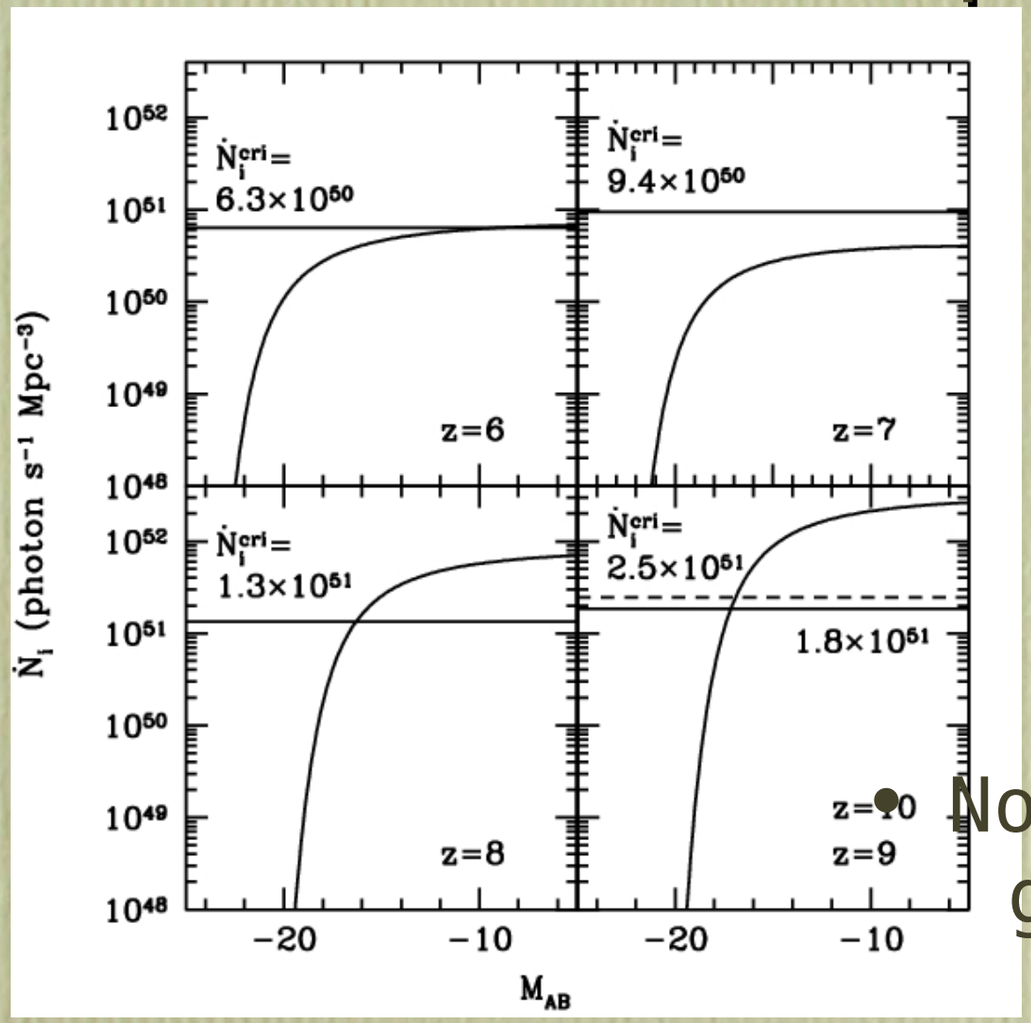


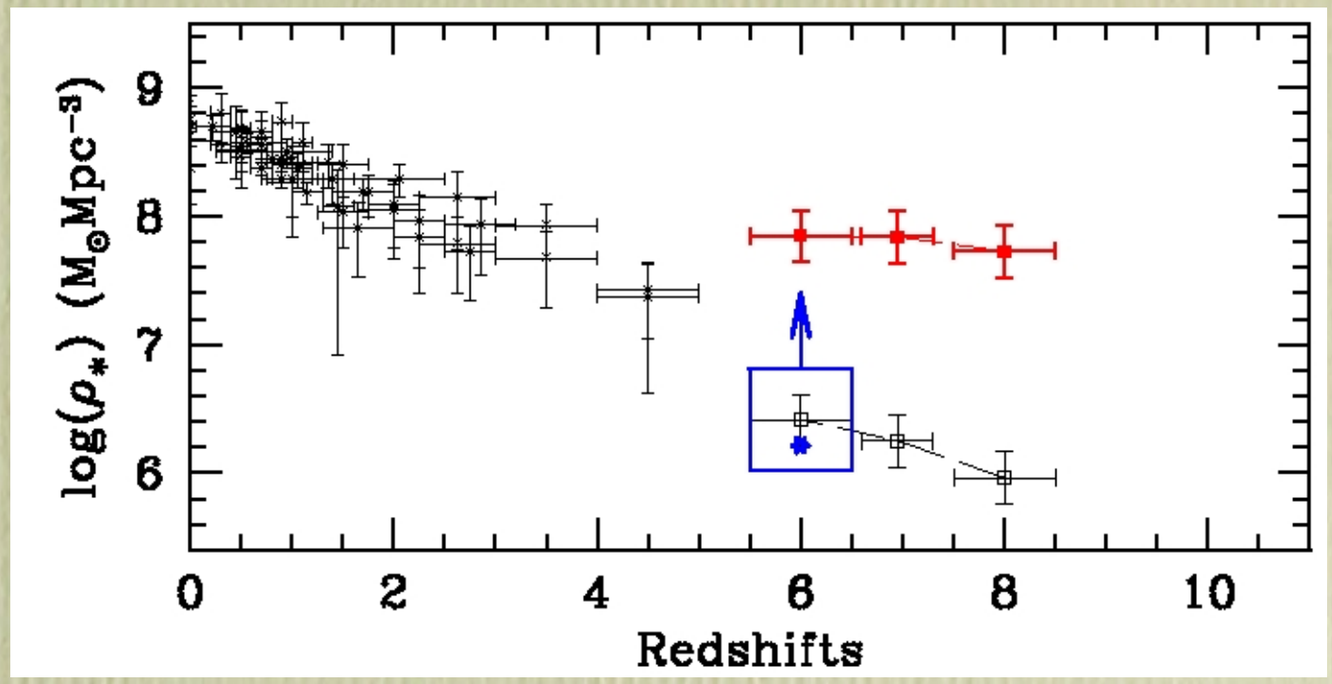
Extrapolate to
M ≈ -15.0 mag
(AB ≈ 32 mag)

to AB~29 mag
(observed)

(Data points at z<6 taken from compilation of Hopkins & Beacom 2006)

While totally unexpected, this result could solve many (every?) problems



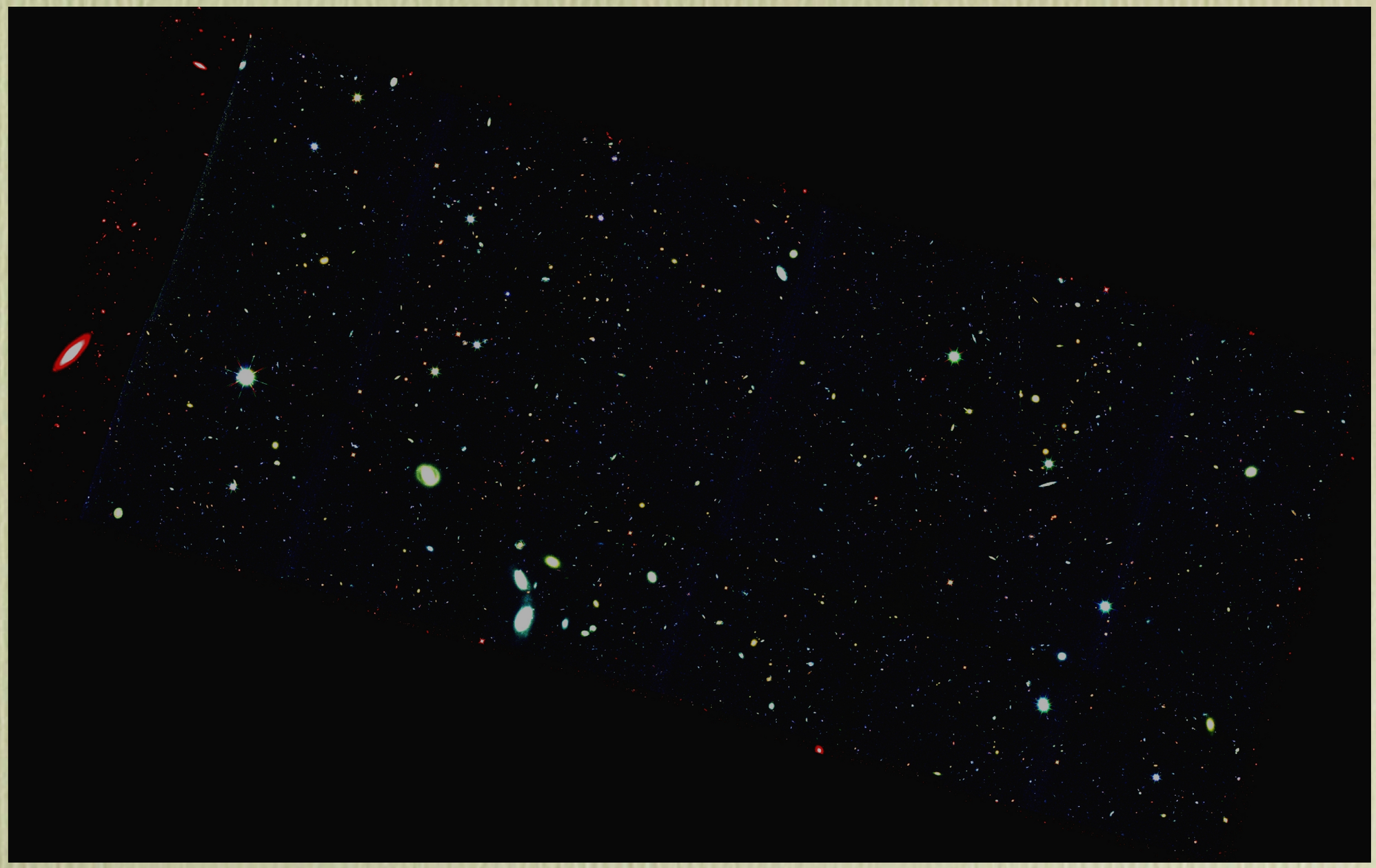


Not a problem in producing high-ma
galaxies at z~6

Not a problem in producing
reionization photons

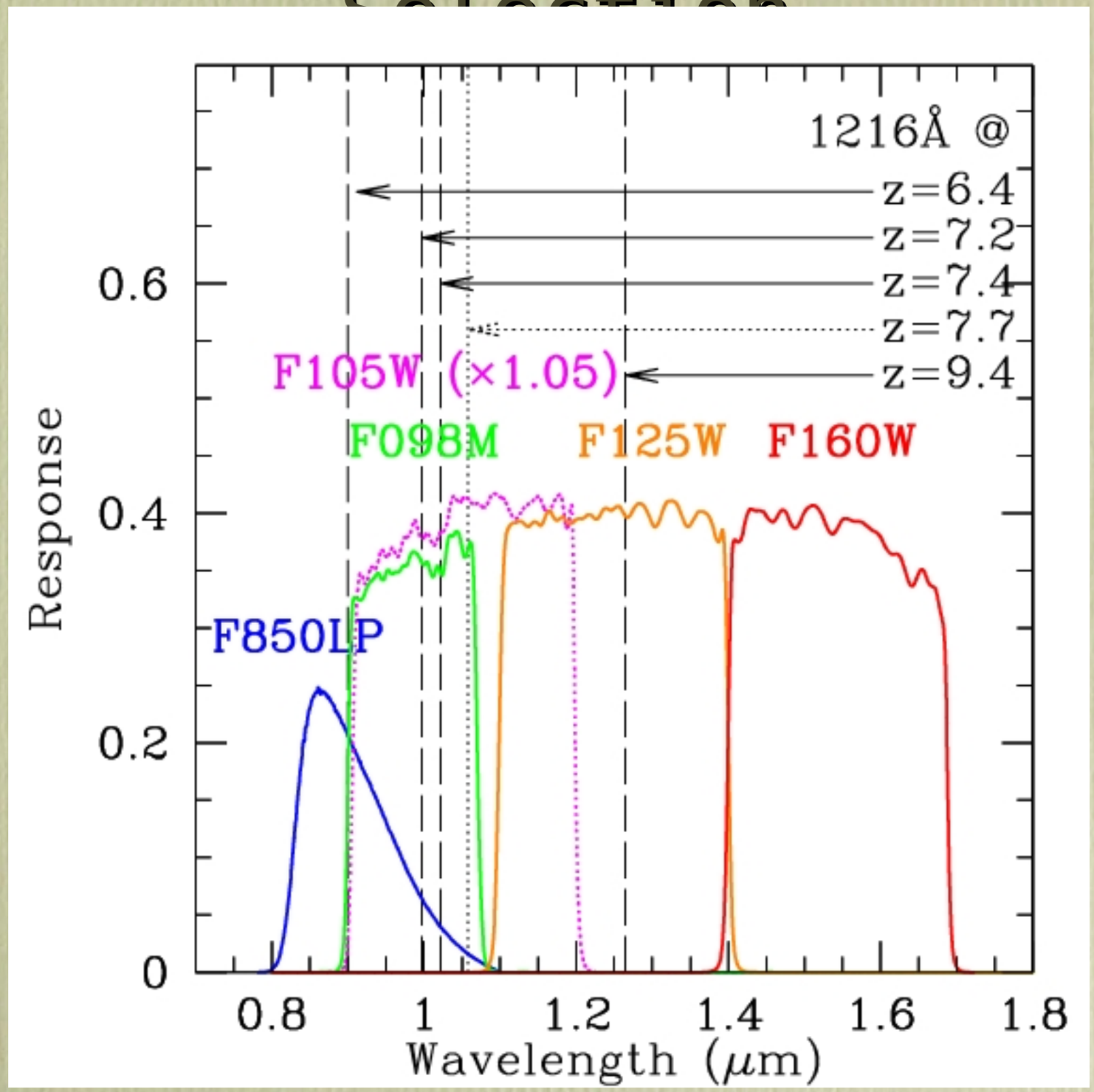
(Yan et al. , arXiv:0910.0077)

WFC3 ERSII IR: 25% of GOODS-S

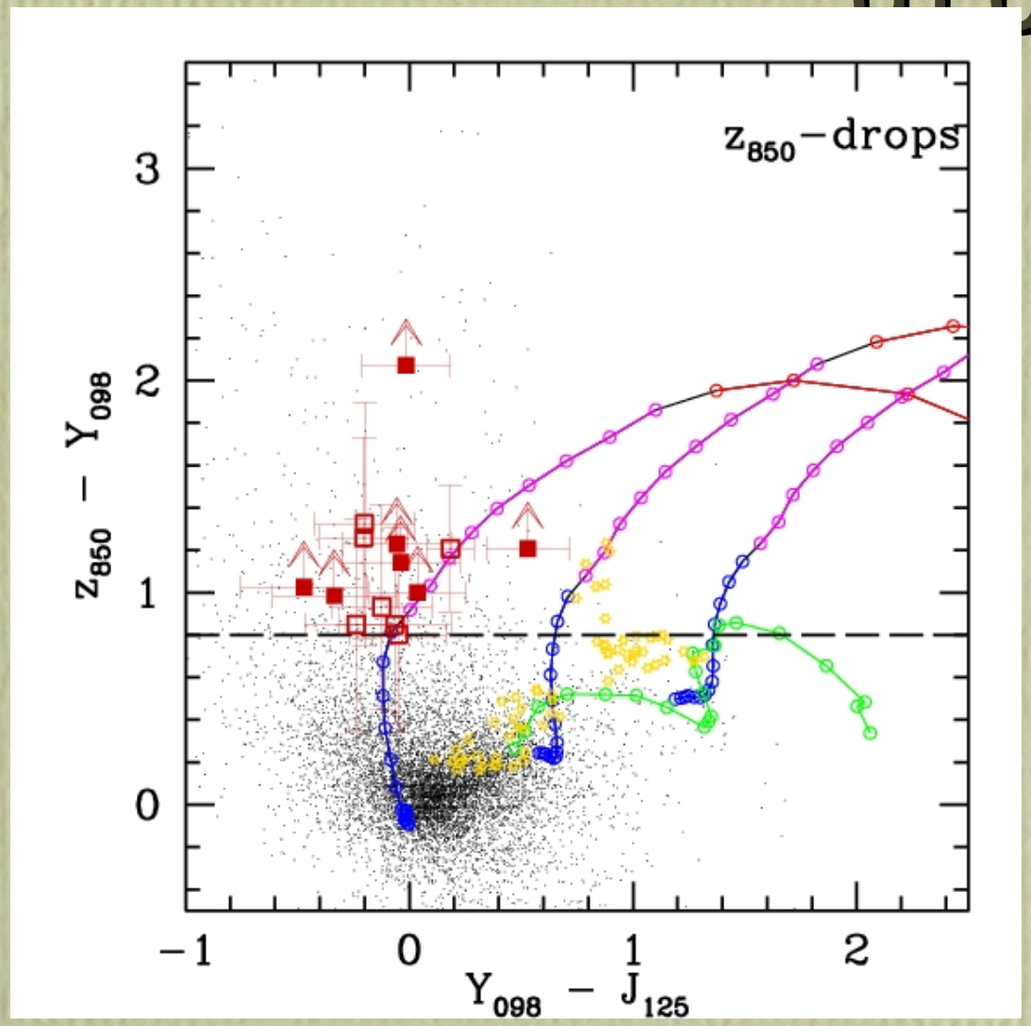


- ~38.48 arcmin^2 overlapping area with GOODS-S ACS
- 2-orbit each in Y_s(F098M), J(F125W) and H(F160W)
- 5-σ limit (r=0.2”): 27.4, 27.8 and 27.6 mag

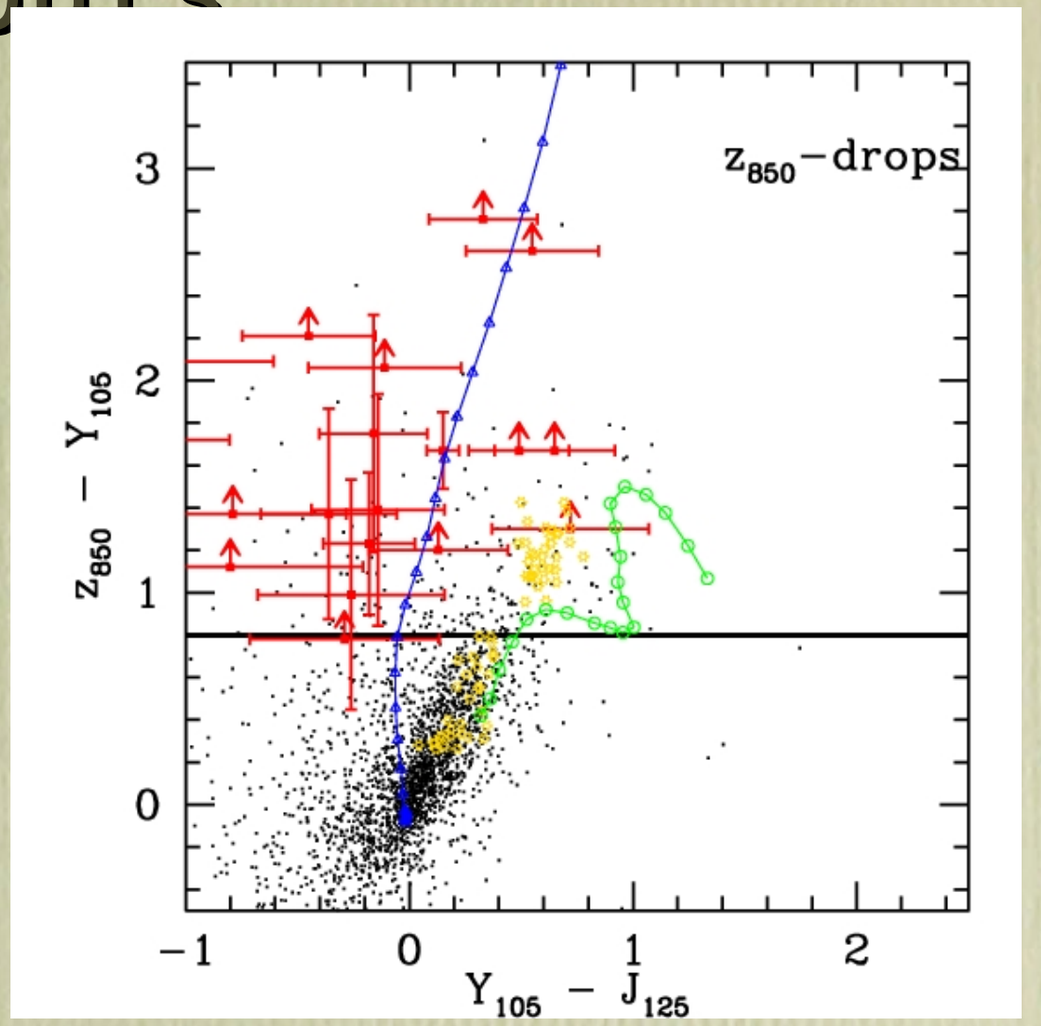
Filter System for High-z Galaxy Selection



Y_s-based Selection of z_{850}-dropouts



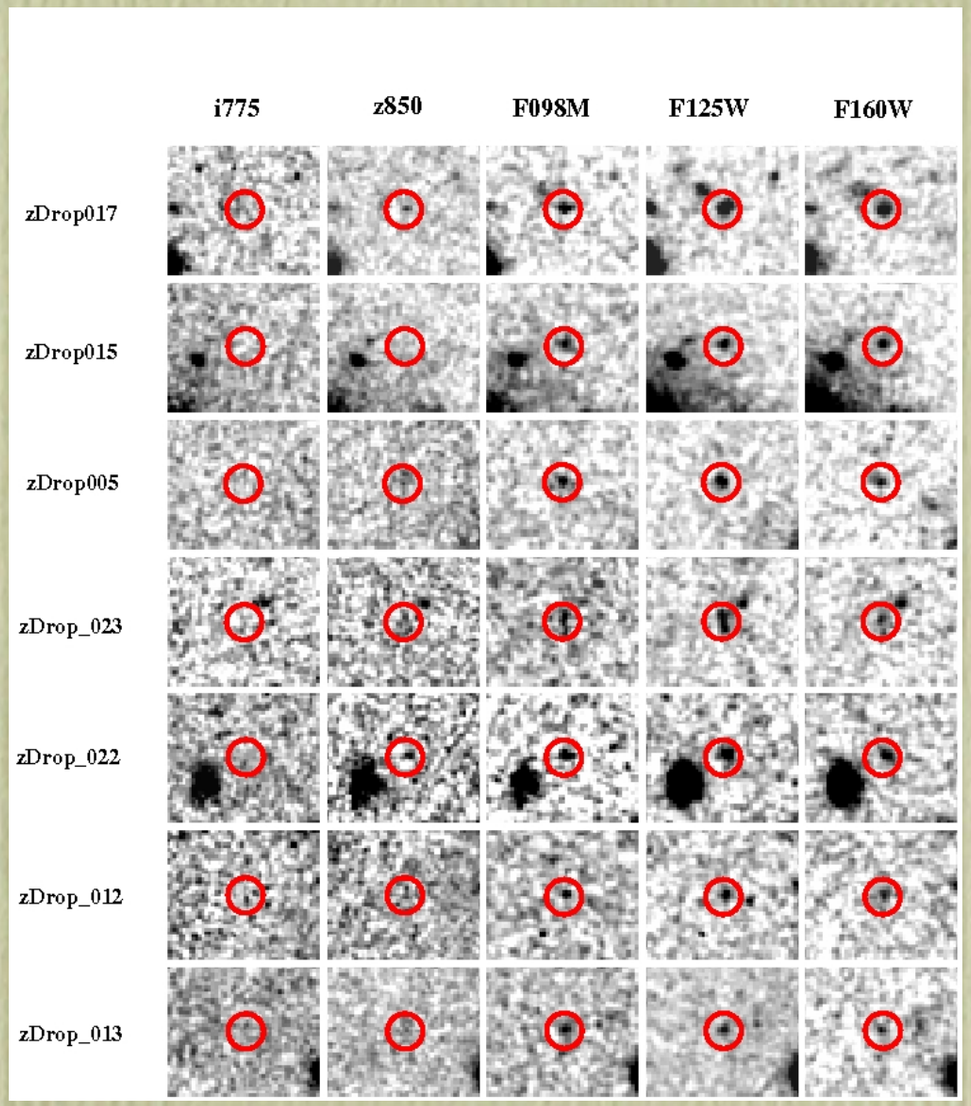
ERS2; Y_s-based

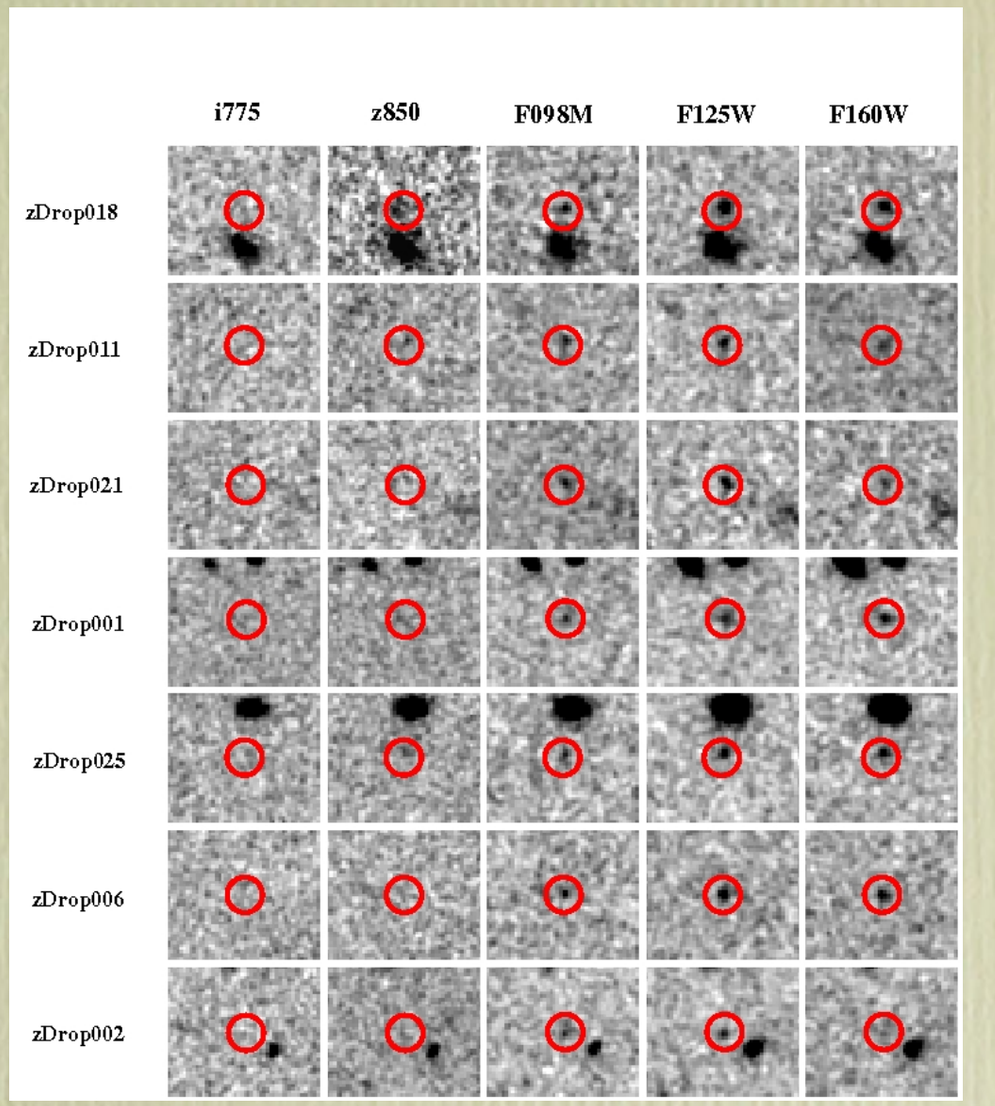


HUDF; Y-based

- Ys-based selection: $6.4 \leq z \leq 7.2$
- Y-based selection: $6.4 \leq z \leq 7.7$

14 Y_s-based z_{850}-dropouts found



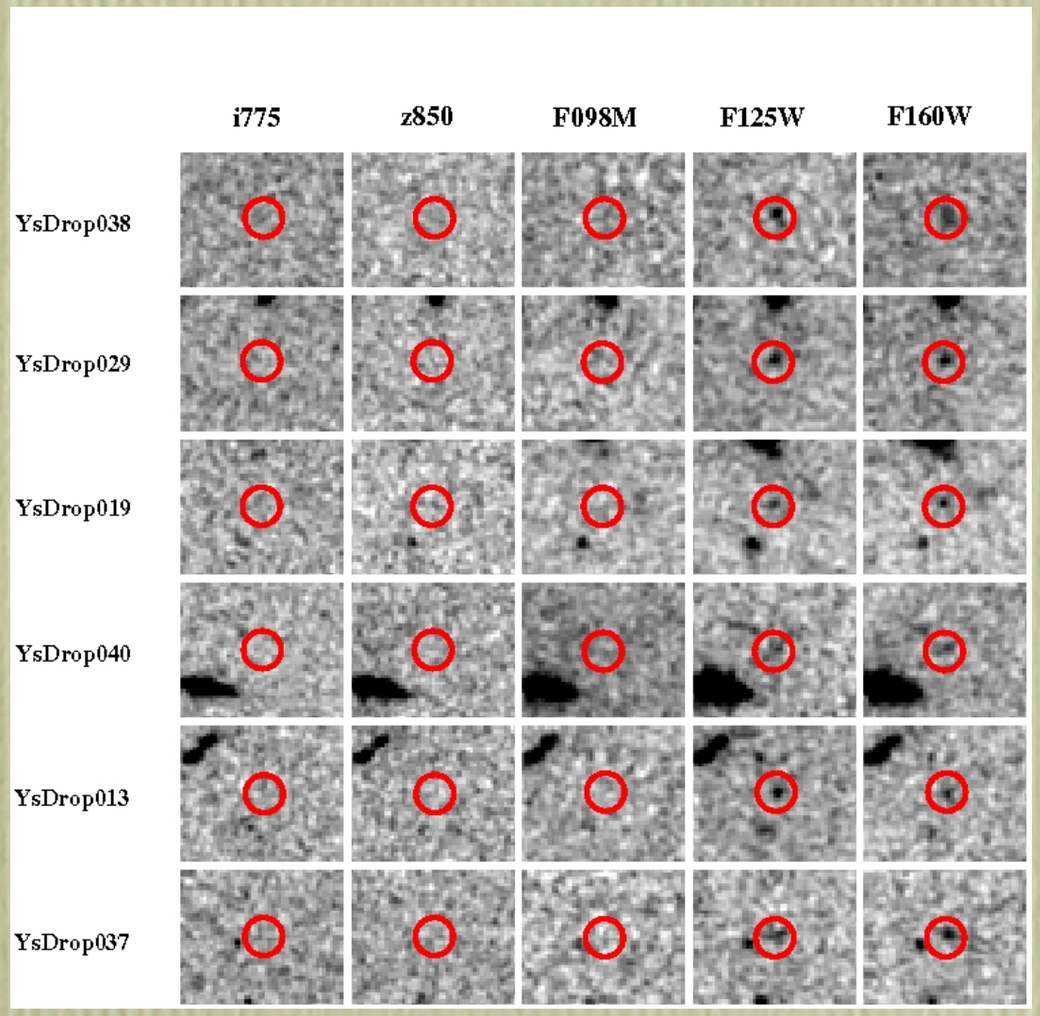


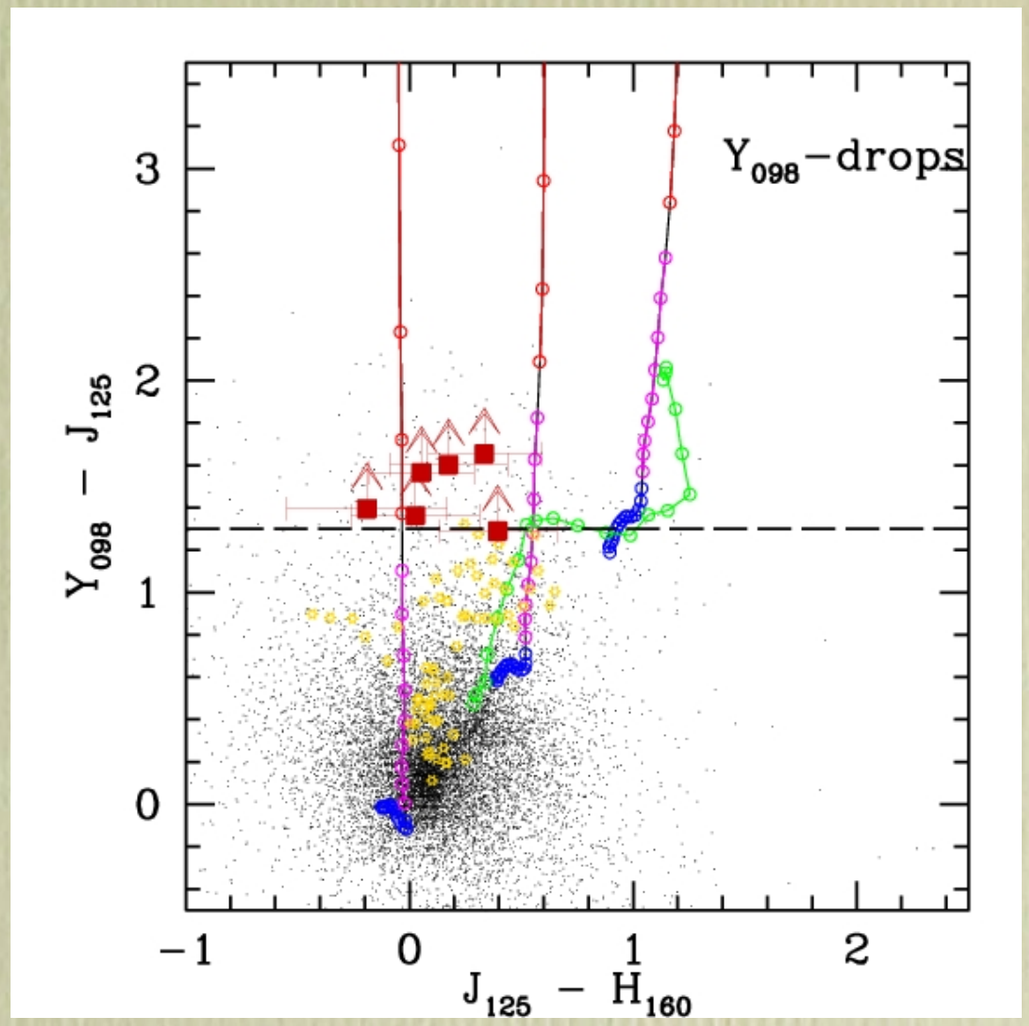
o more bright z_{850}-dropouts (Ys<26.5 mag)

ne of these 14 objects are significant detections in IRAC

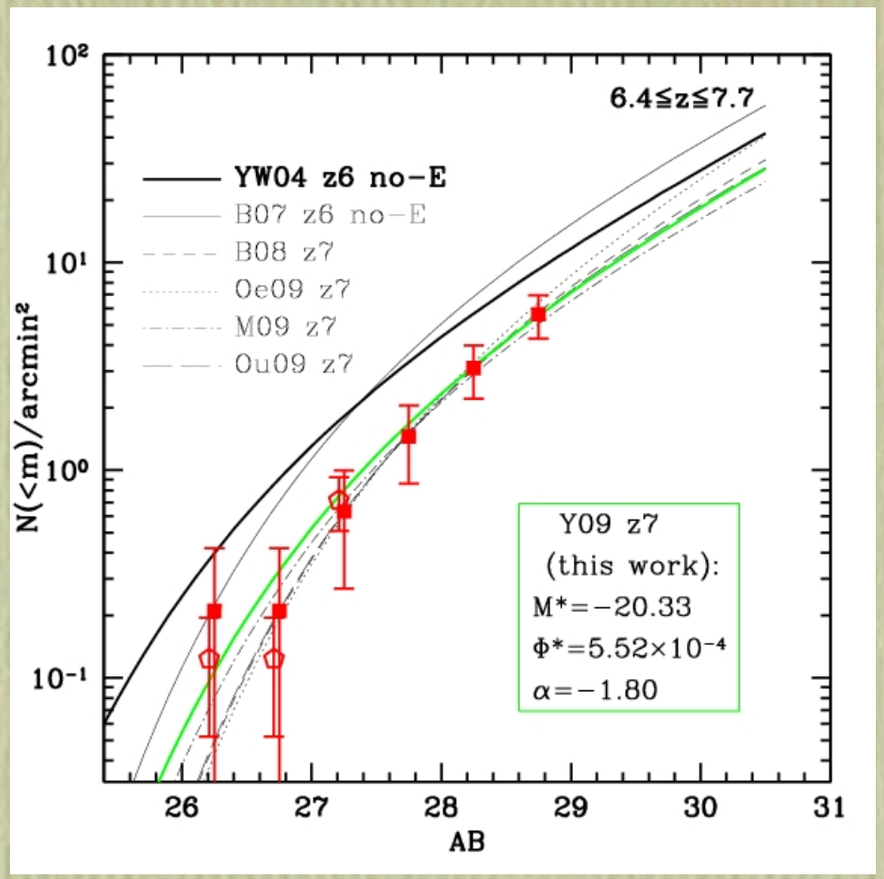
stellar masses ~ 1e9 Msun; agree with Labbe et al. (0911.

Six Ys-dropouts found

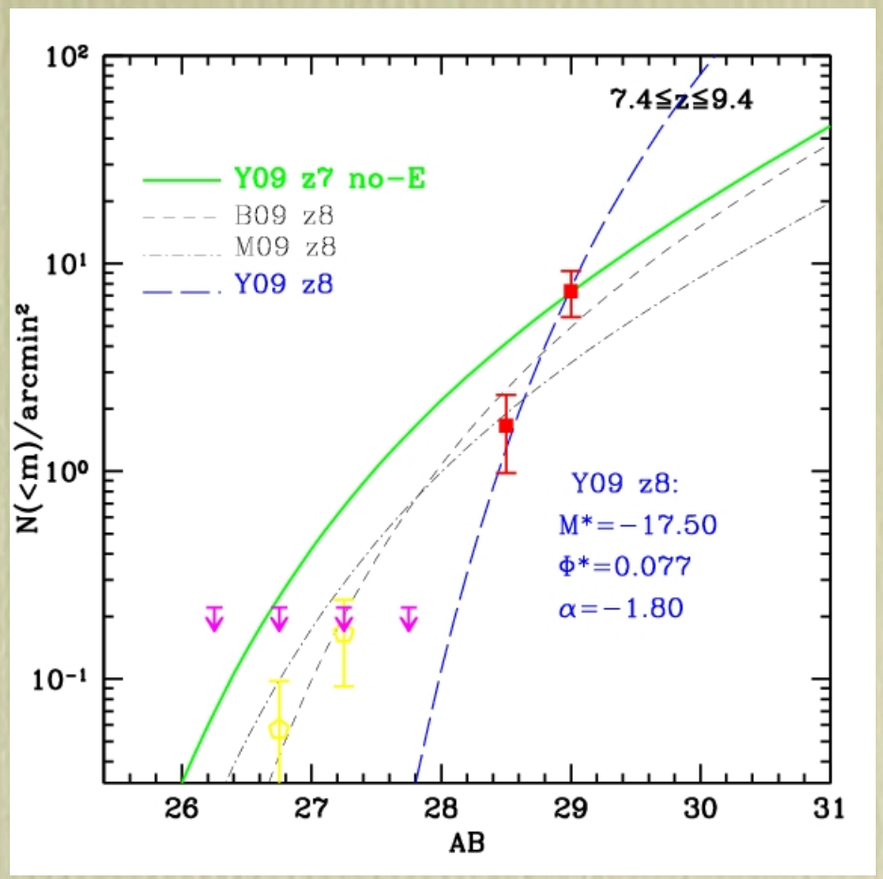




- All brighter than J=27.8 mag
- Candidates at z>7.4, but not necessarily at z>7.7
- Further constraints to their

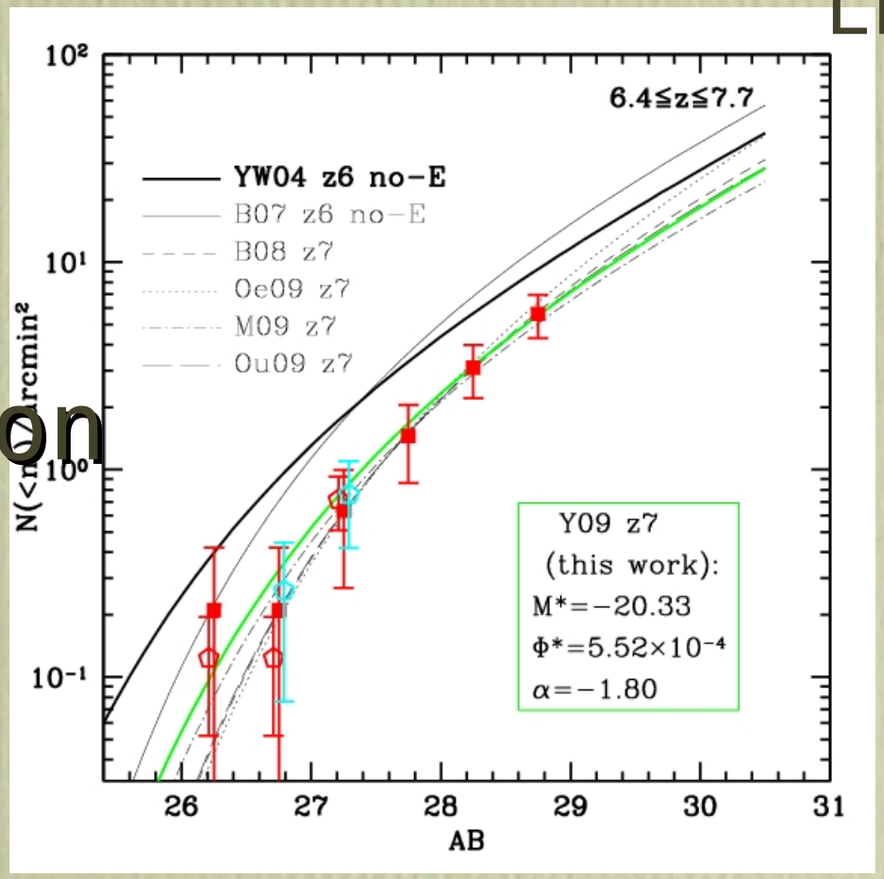


LF at z~7: good agreement

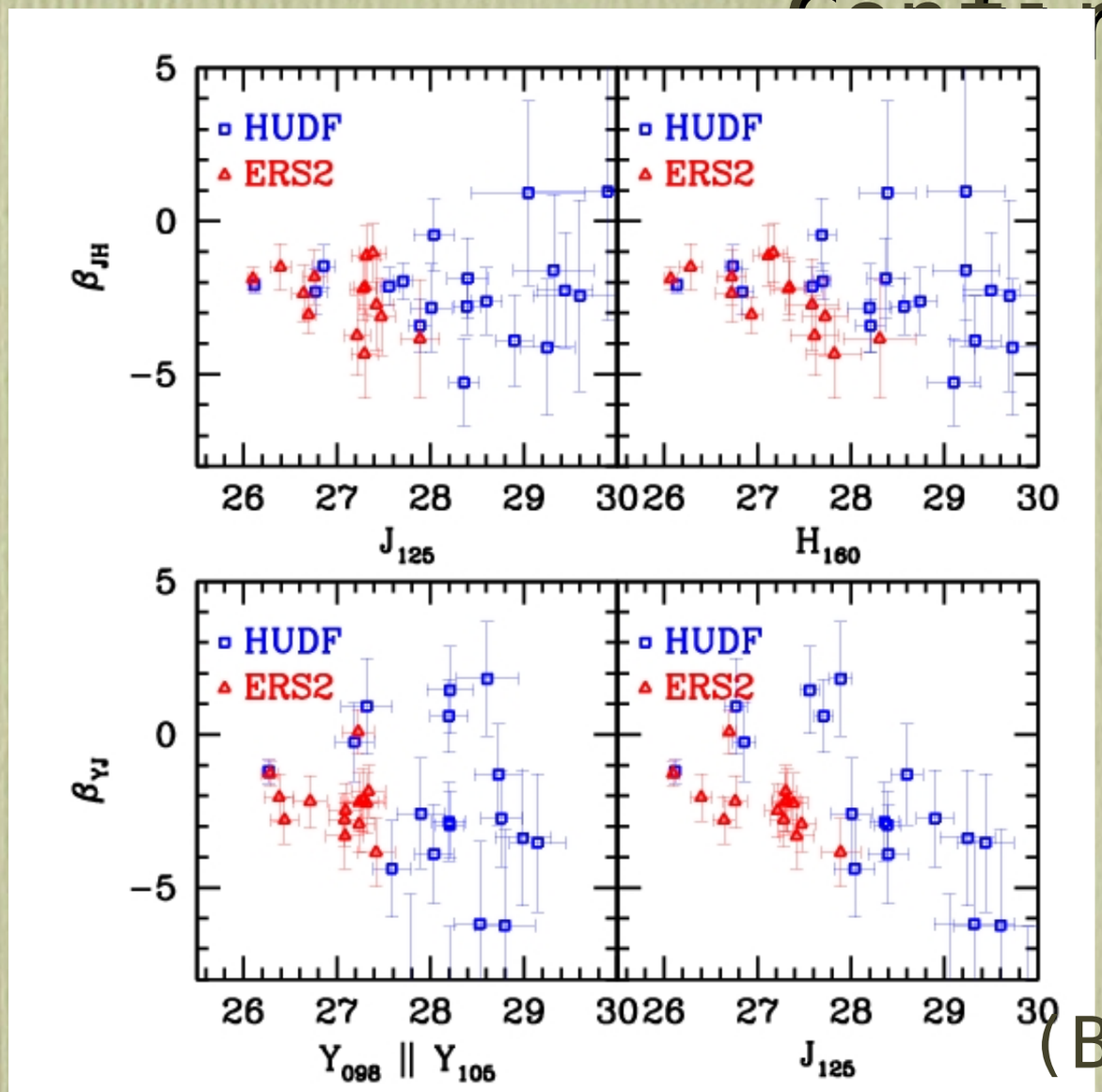


LF at z ~ 8.5 ??

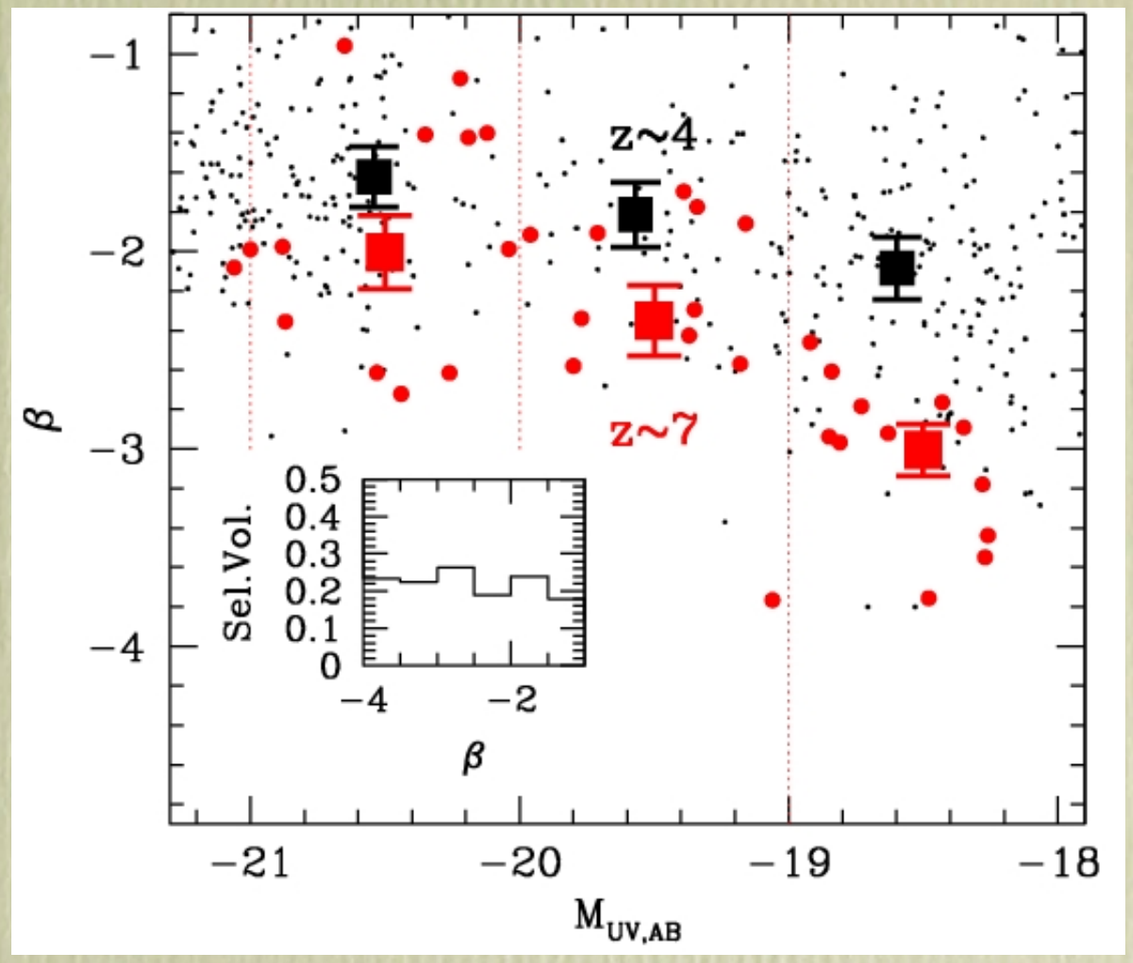
Possible solution



Presence of Blue Restframe UV Slopes Confirmed



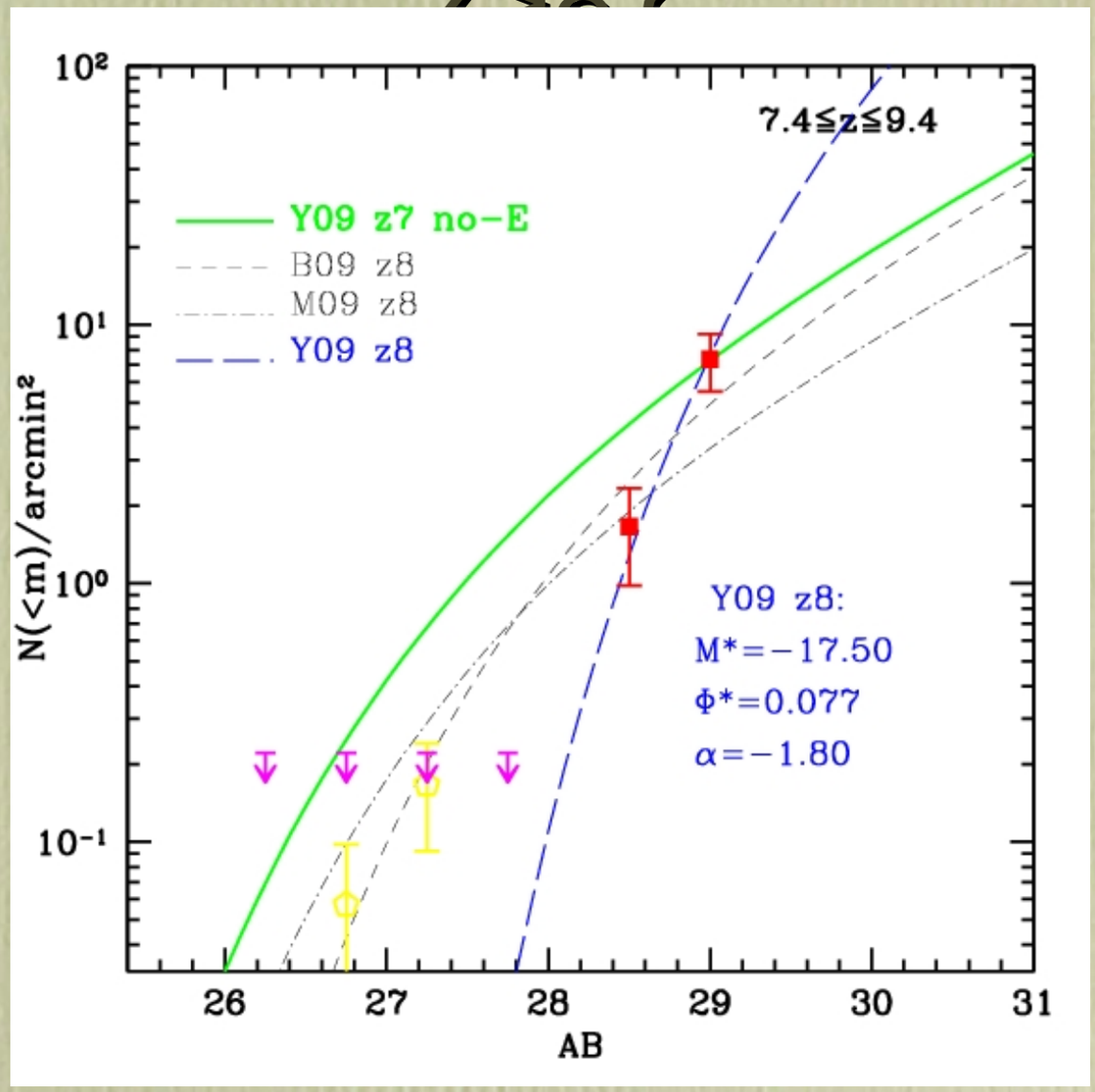
(Yan et al. 2009b)



(Bouwens et al.; M_{UV} from J+H)

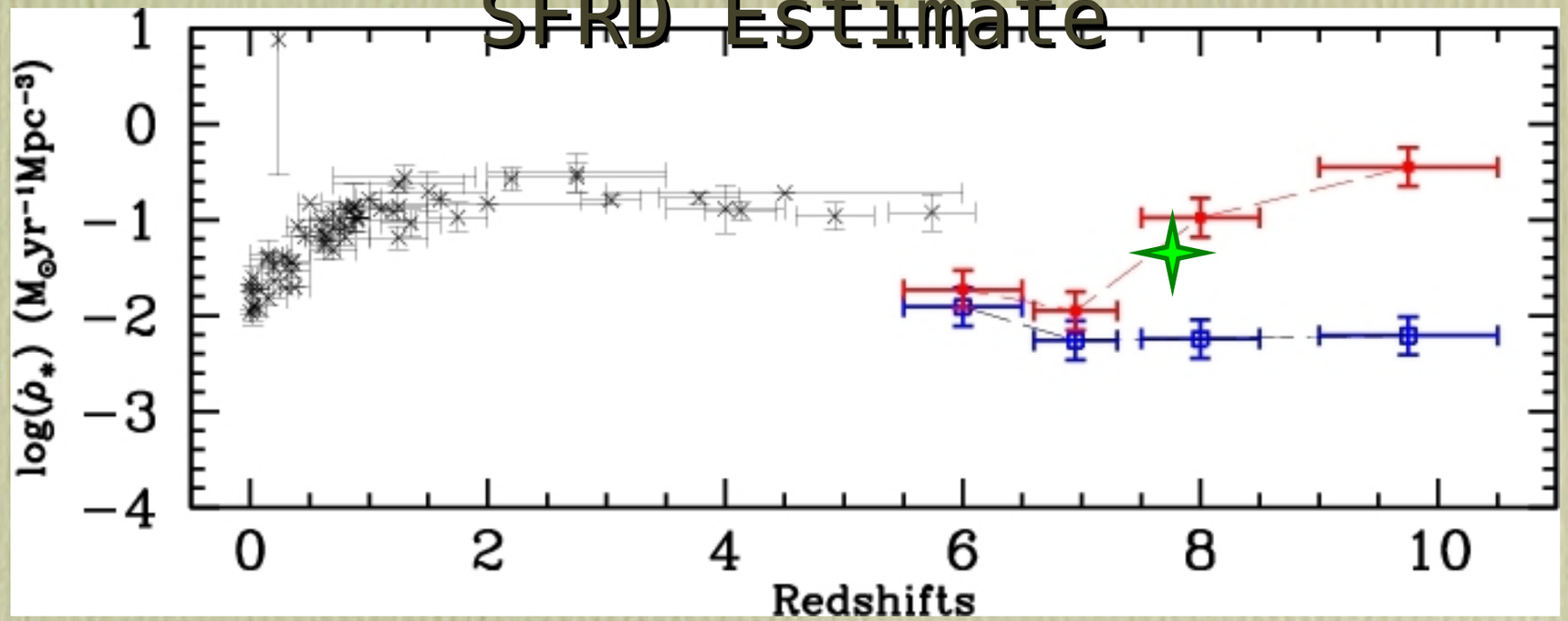
r not necessarily the trend of decreasing beta w.r.t decr
ed by Bouwens et al. (0910.0001)

Exponential Part of the LF at z>8?

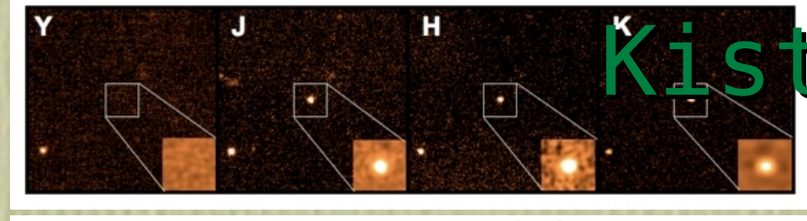


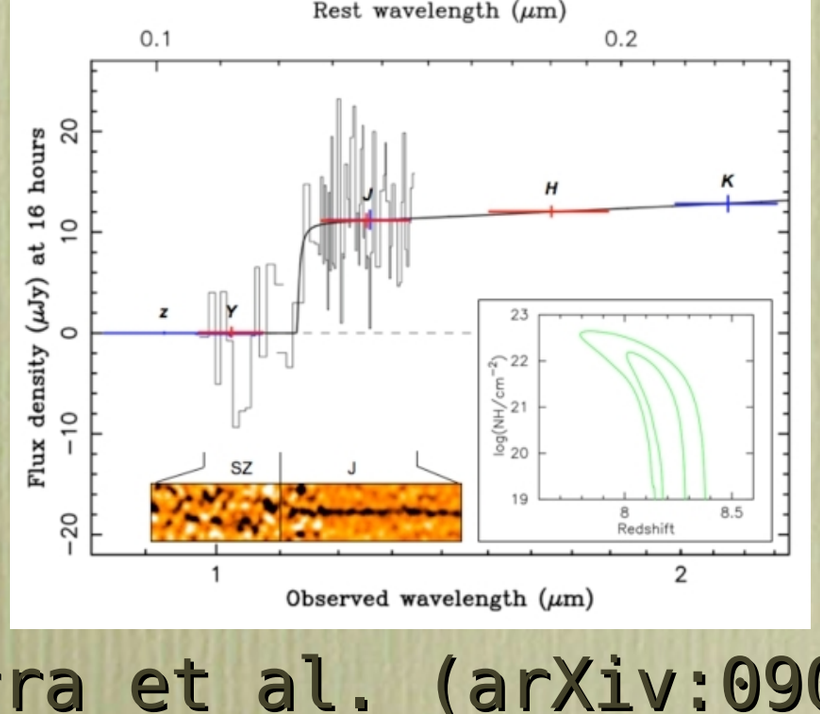
Searching around lensing clusters might be importa

(In)direct Supporting Evidence from GRB-based SFRD Estimate

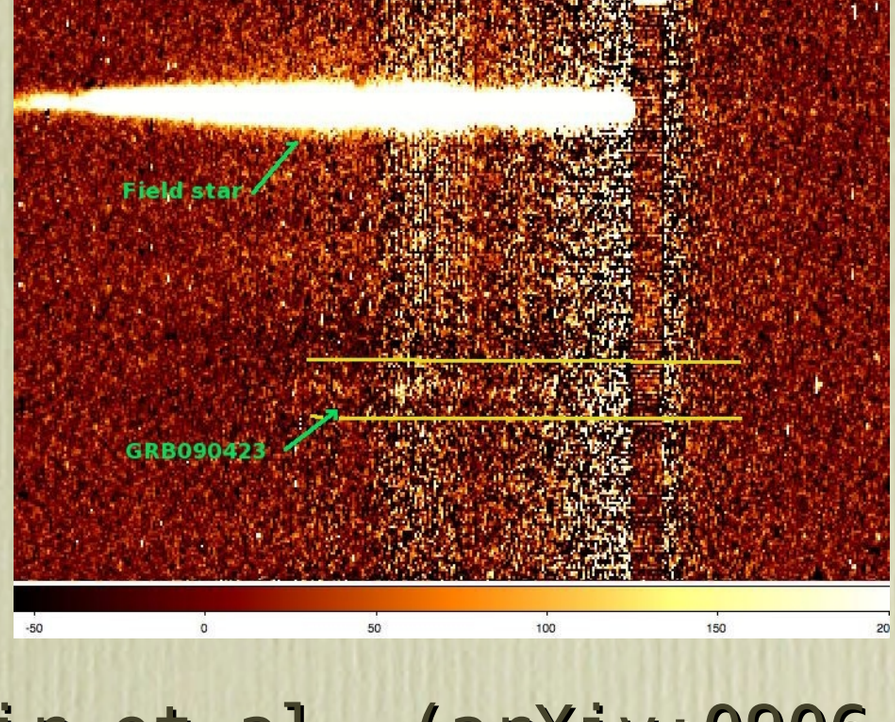


Kistler et al. (arXiv:0906:0590)



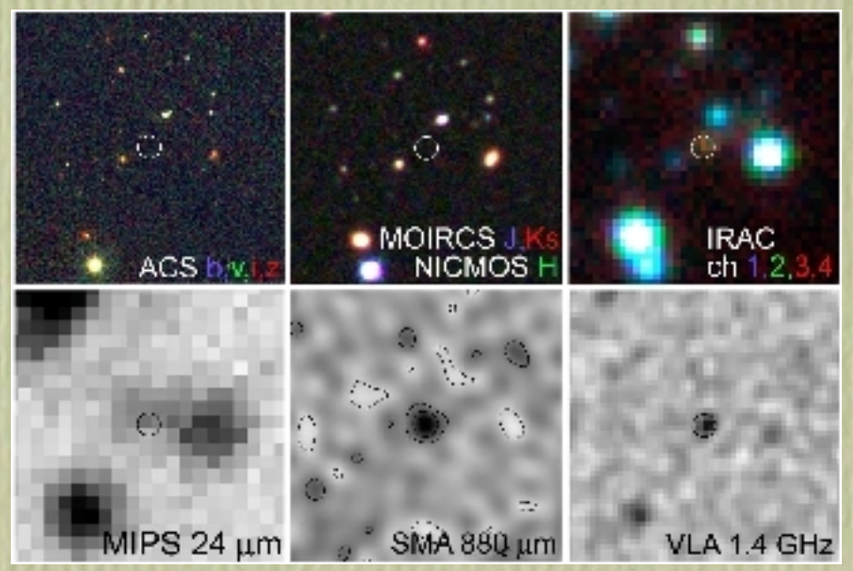


GRB 090423
@ z=8.26

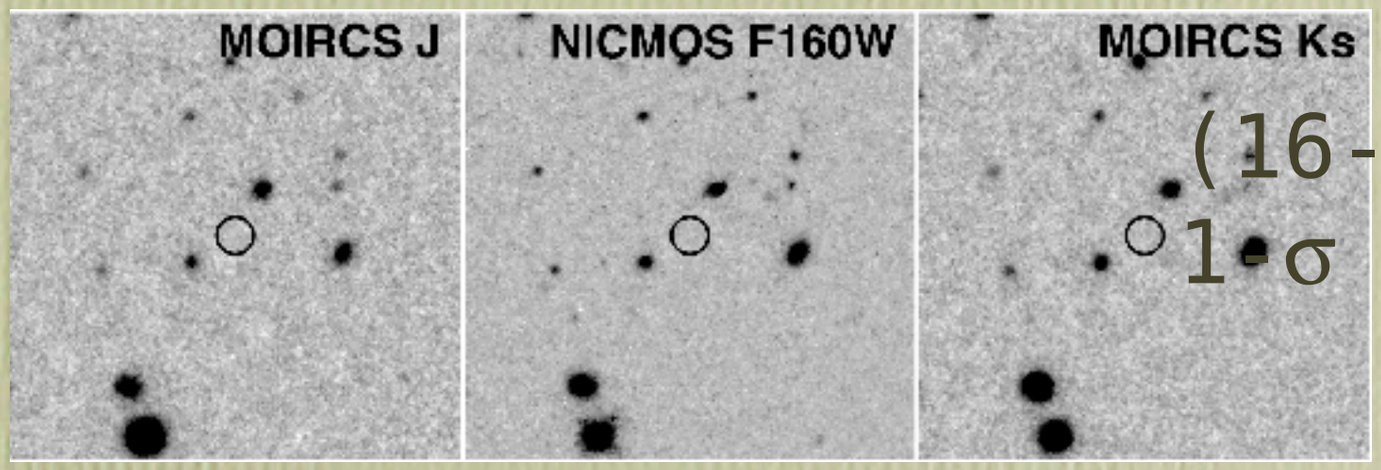


aterra et al. (arXiv:0906.1578) Tanvir et al. (arXiv:0906.157

Hidden High-SFR Galaxies at vhz?



Wang et al. (2008) SMG GOODS 850-5



(16-orbit in NIC3 F160W
1-σ 29.7AB, or 5-σ ~28.0

sensitivity WFC3 could help further constrain rec