STAR-FORMING GALAXIES AT Z≈8-9 FROM *HST*/WFC3: IMPLICATIONS FOR REIONIZATION

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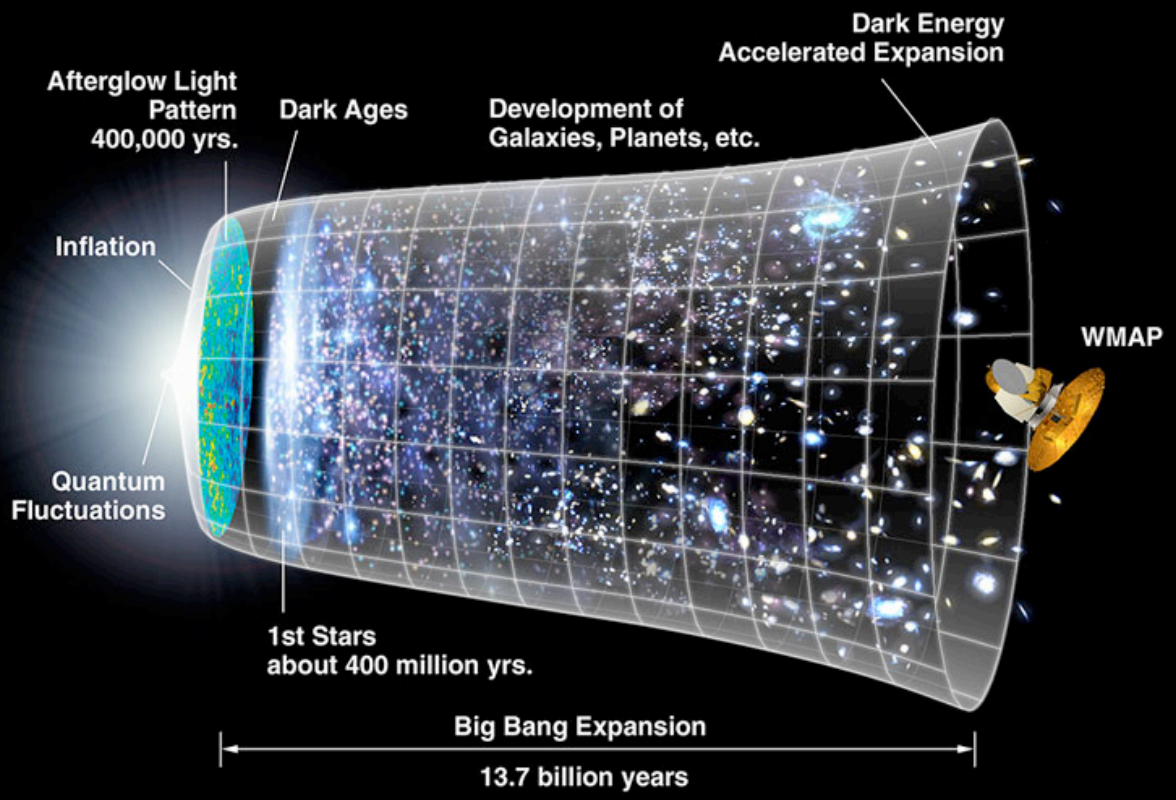
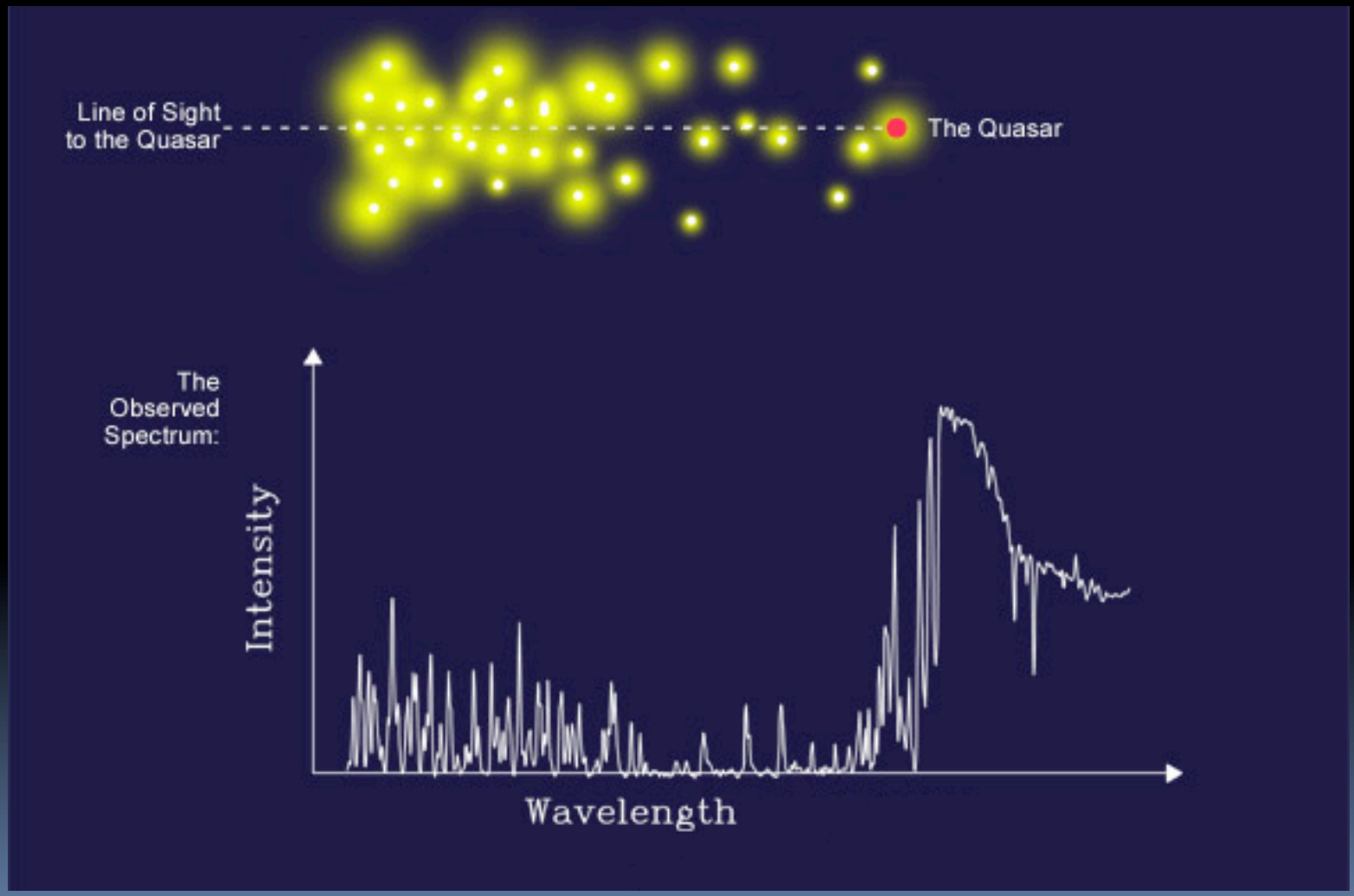
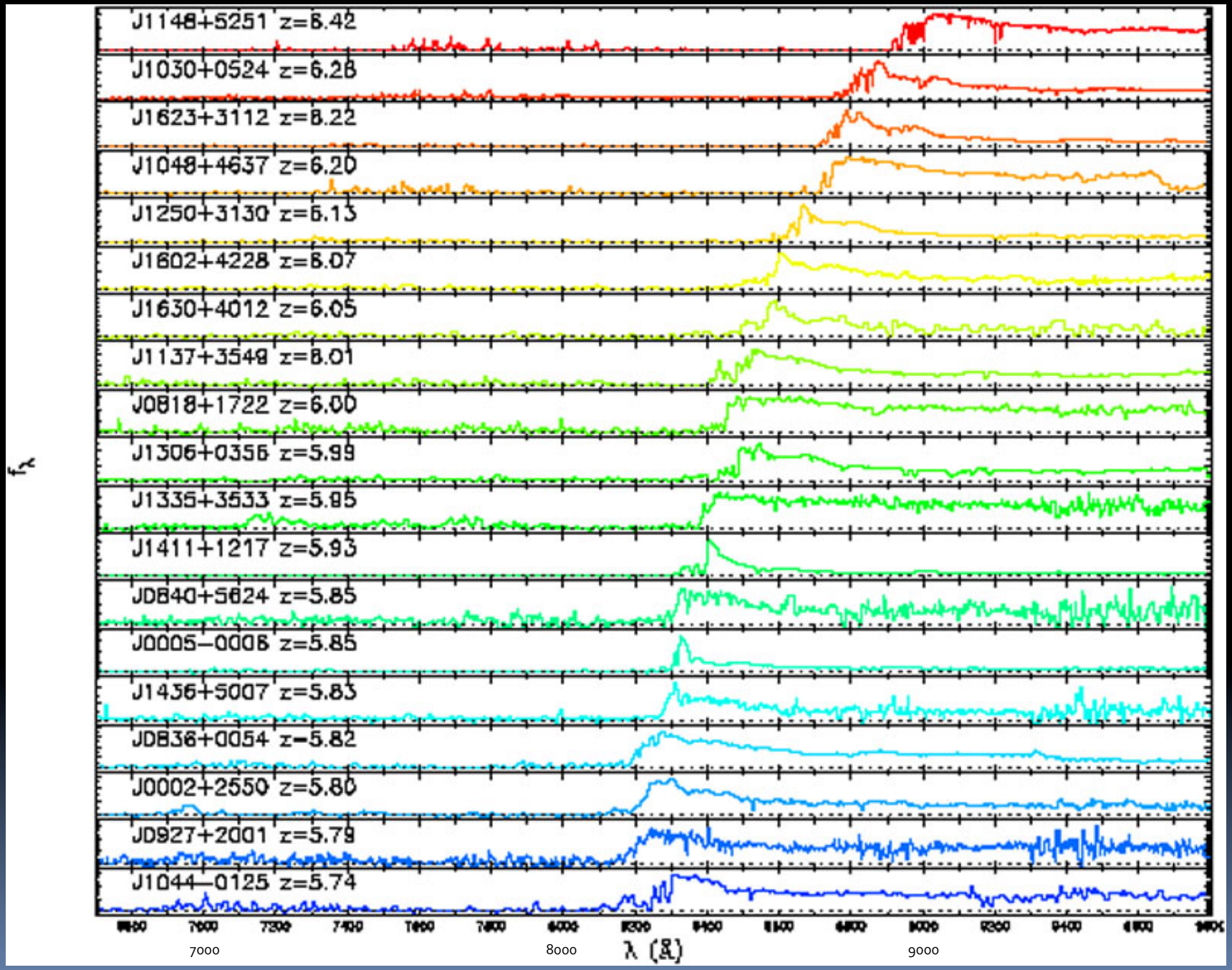
Oxford Physics

Reionization



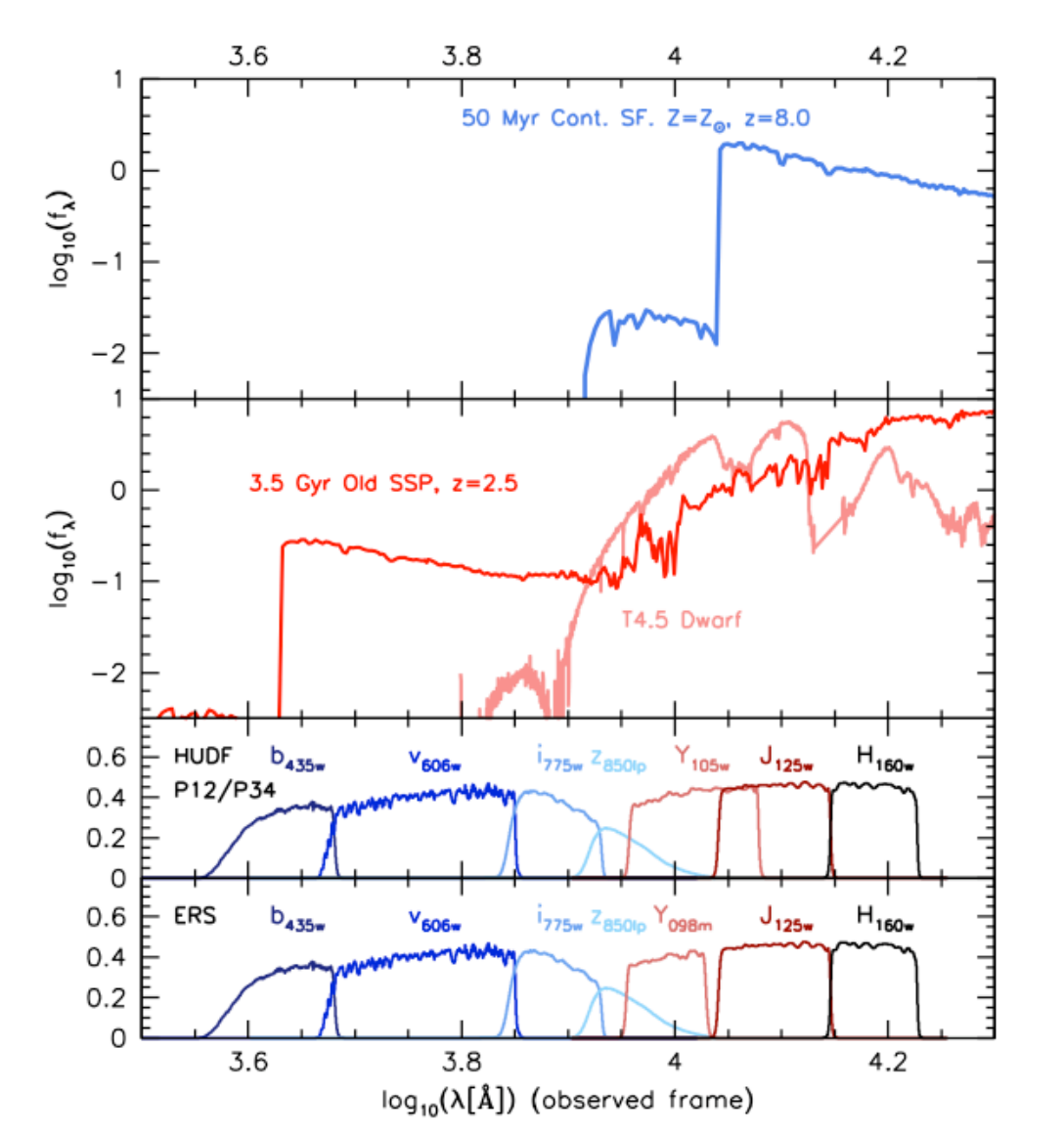
Gunn-Peterson effect





Fan et al. (2006), AJ 132 117

Lyman break technique



Data

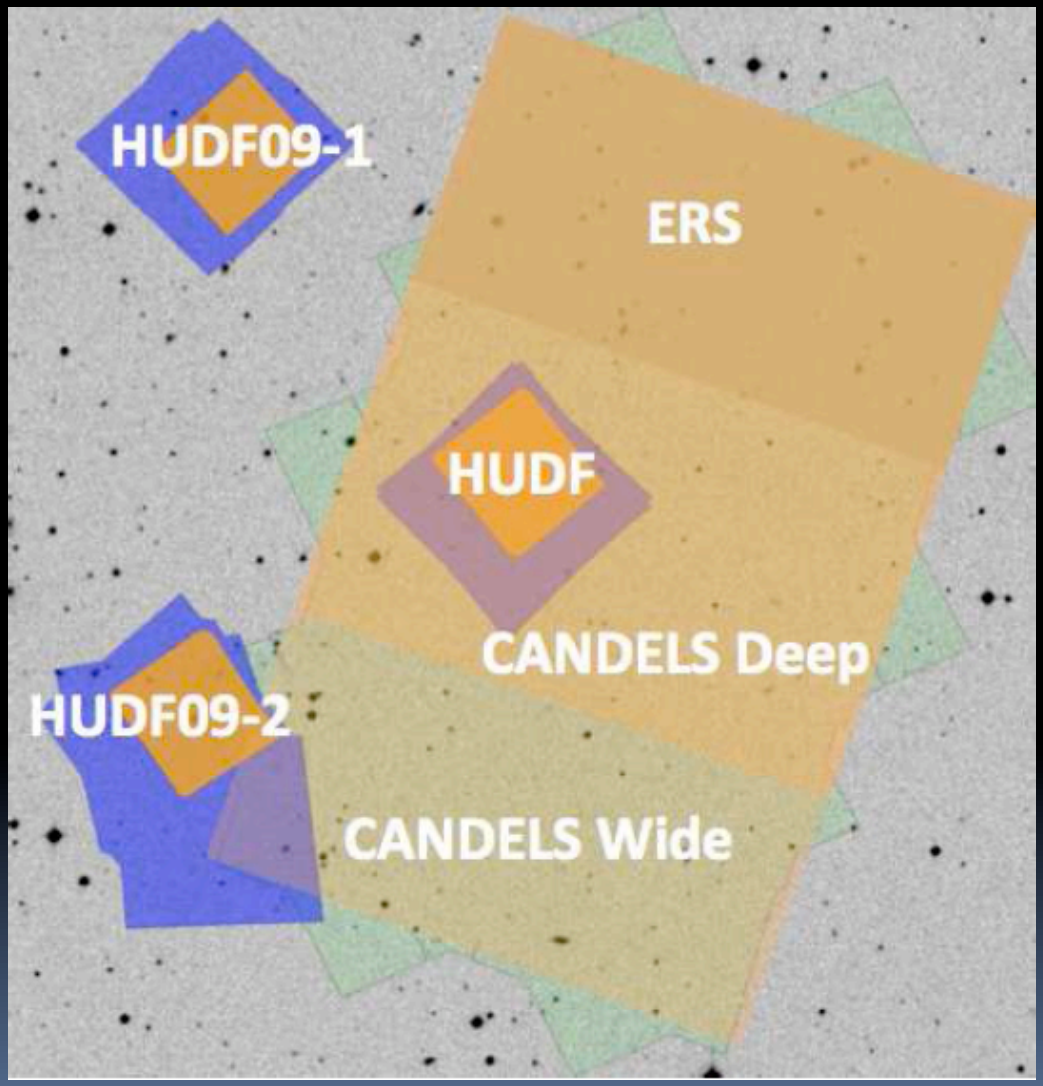
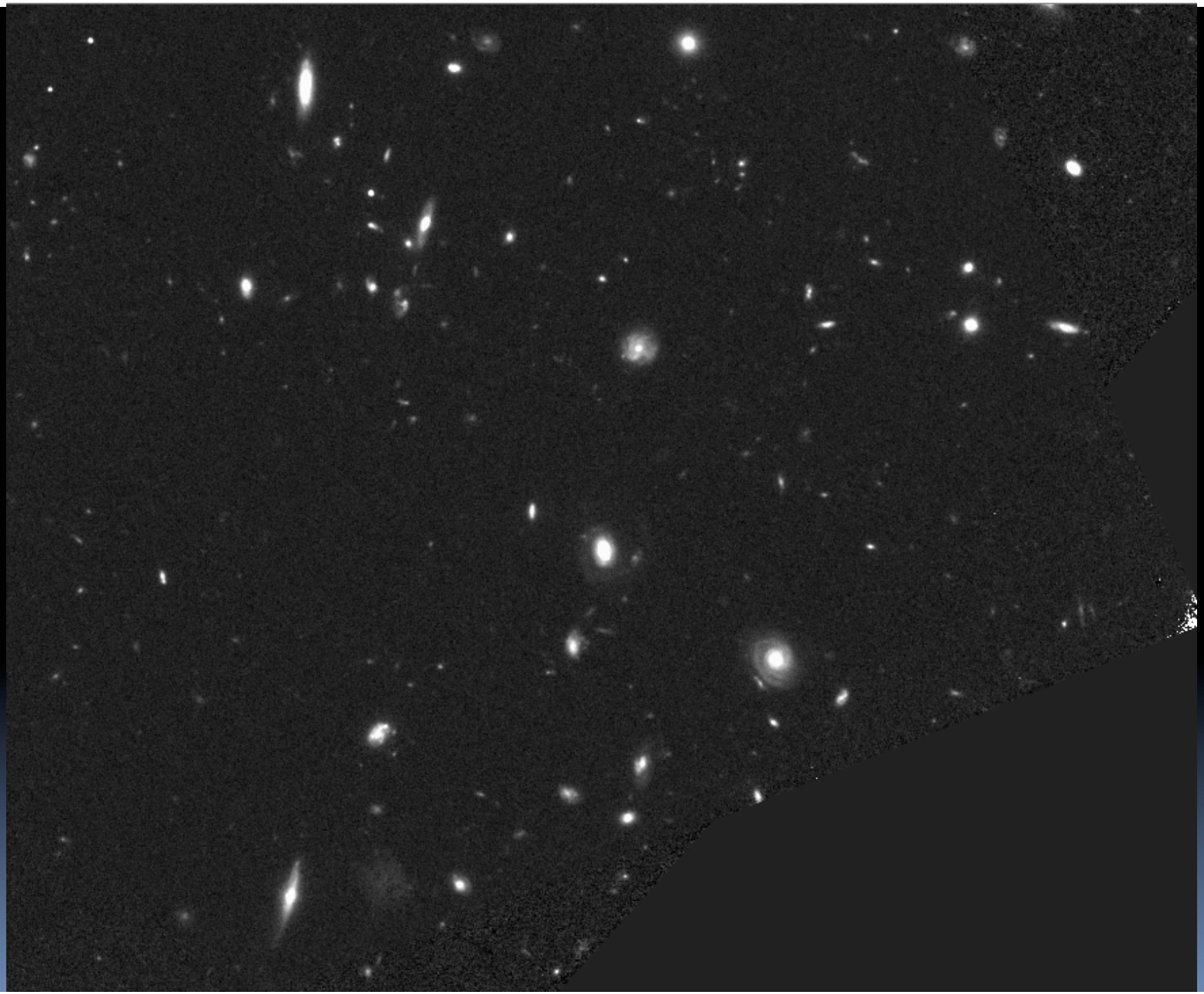
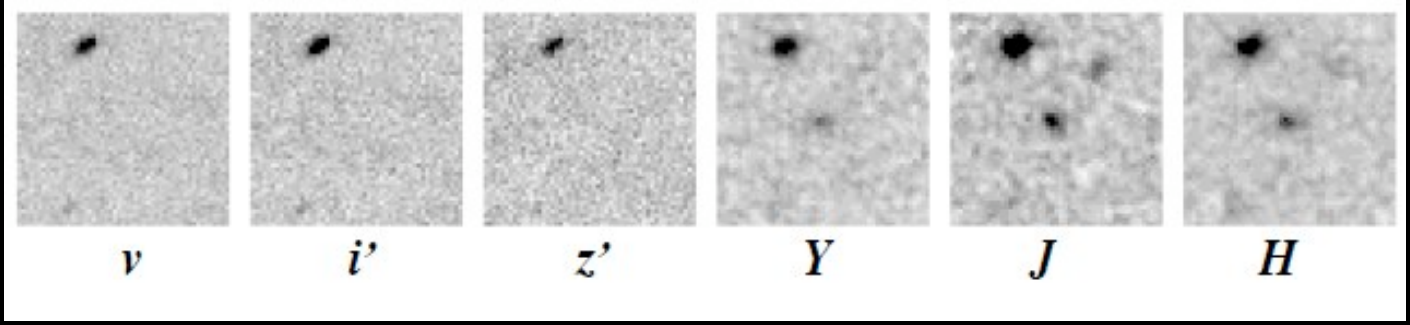


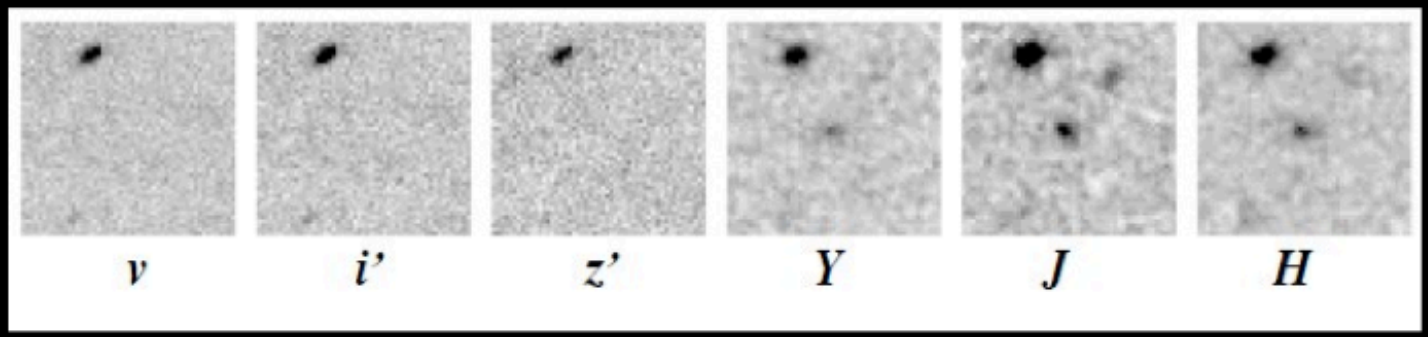
Figure from Oesch et al. (2011), arXiv:1105.2297



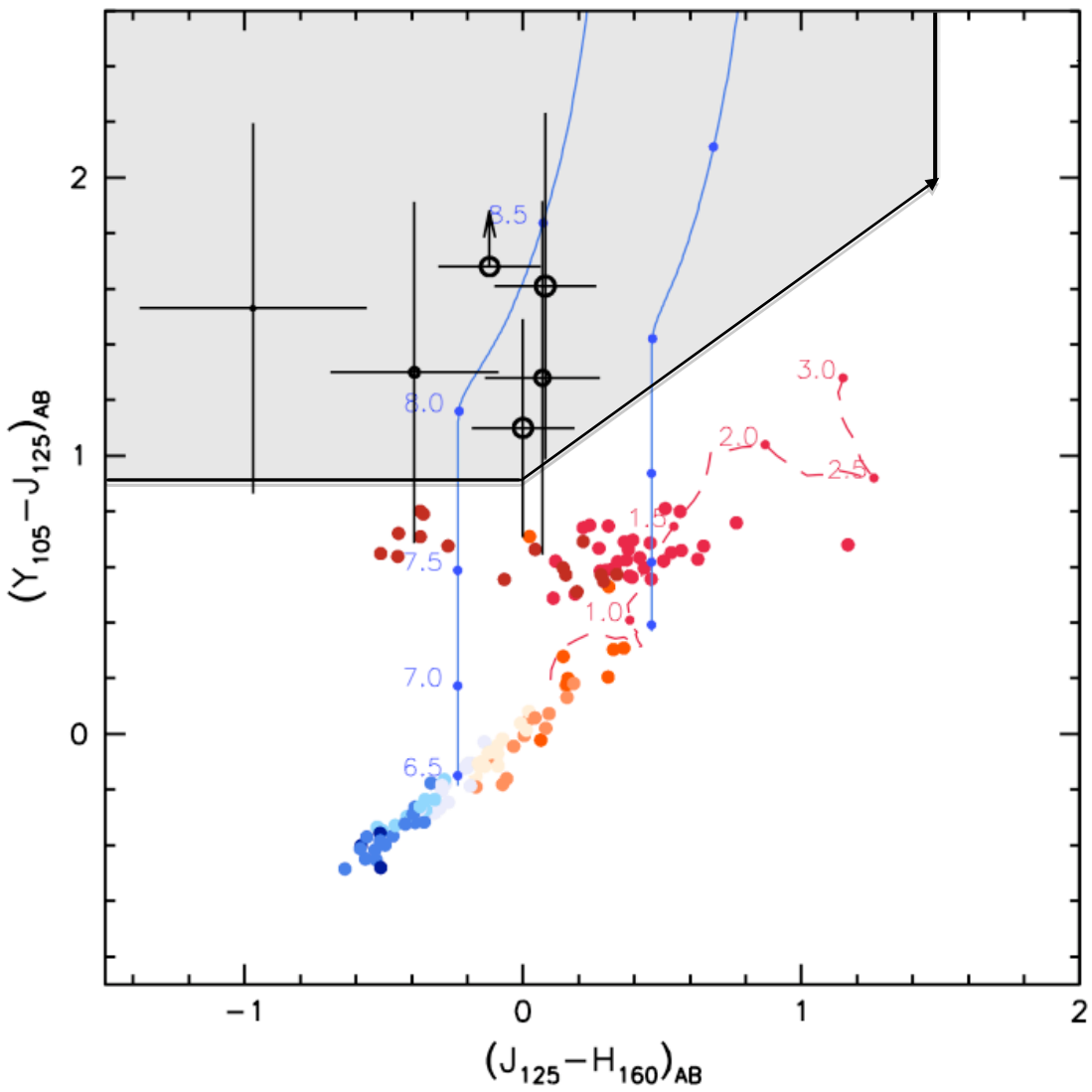
Candidates



Candidates

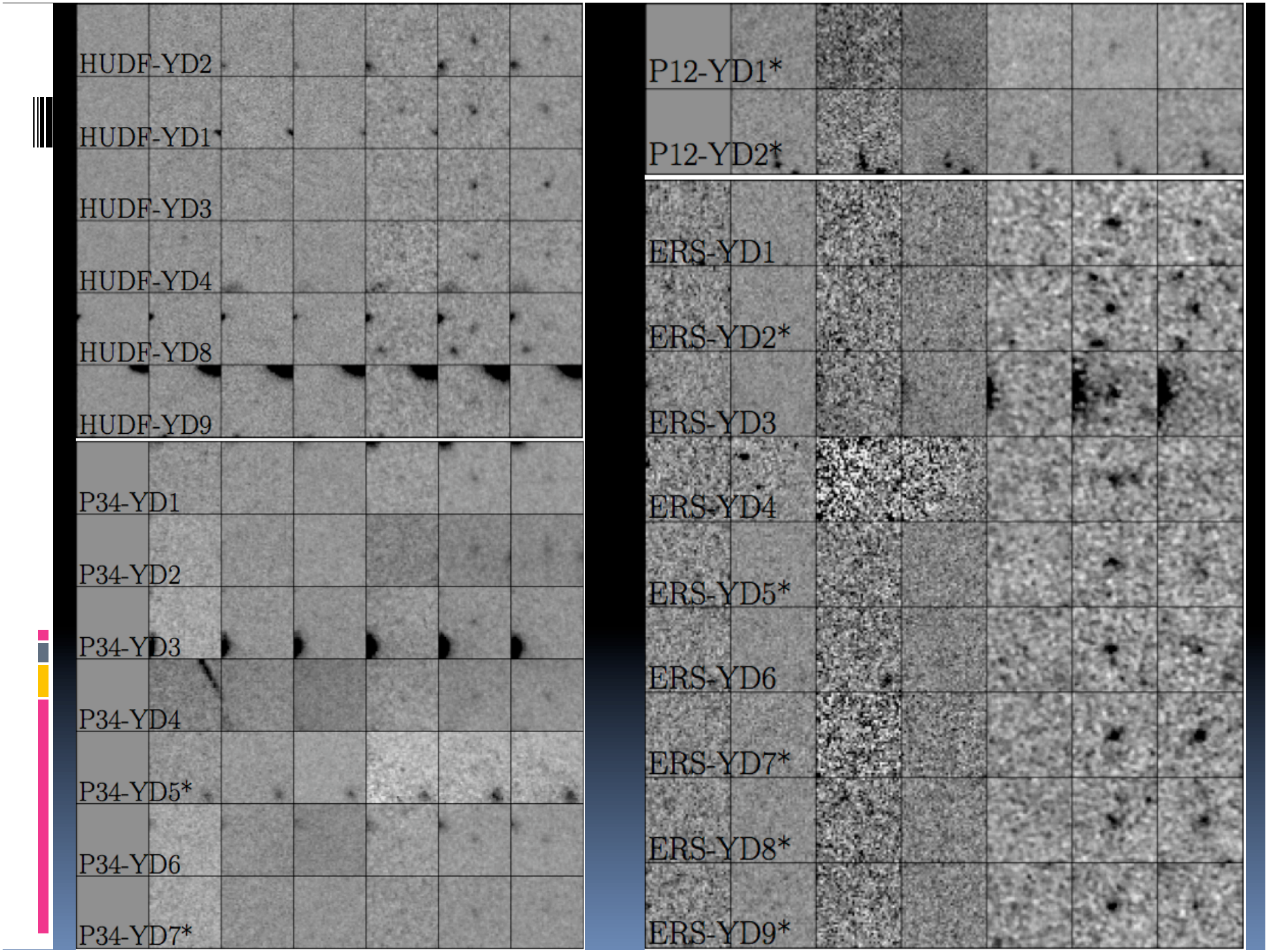


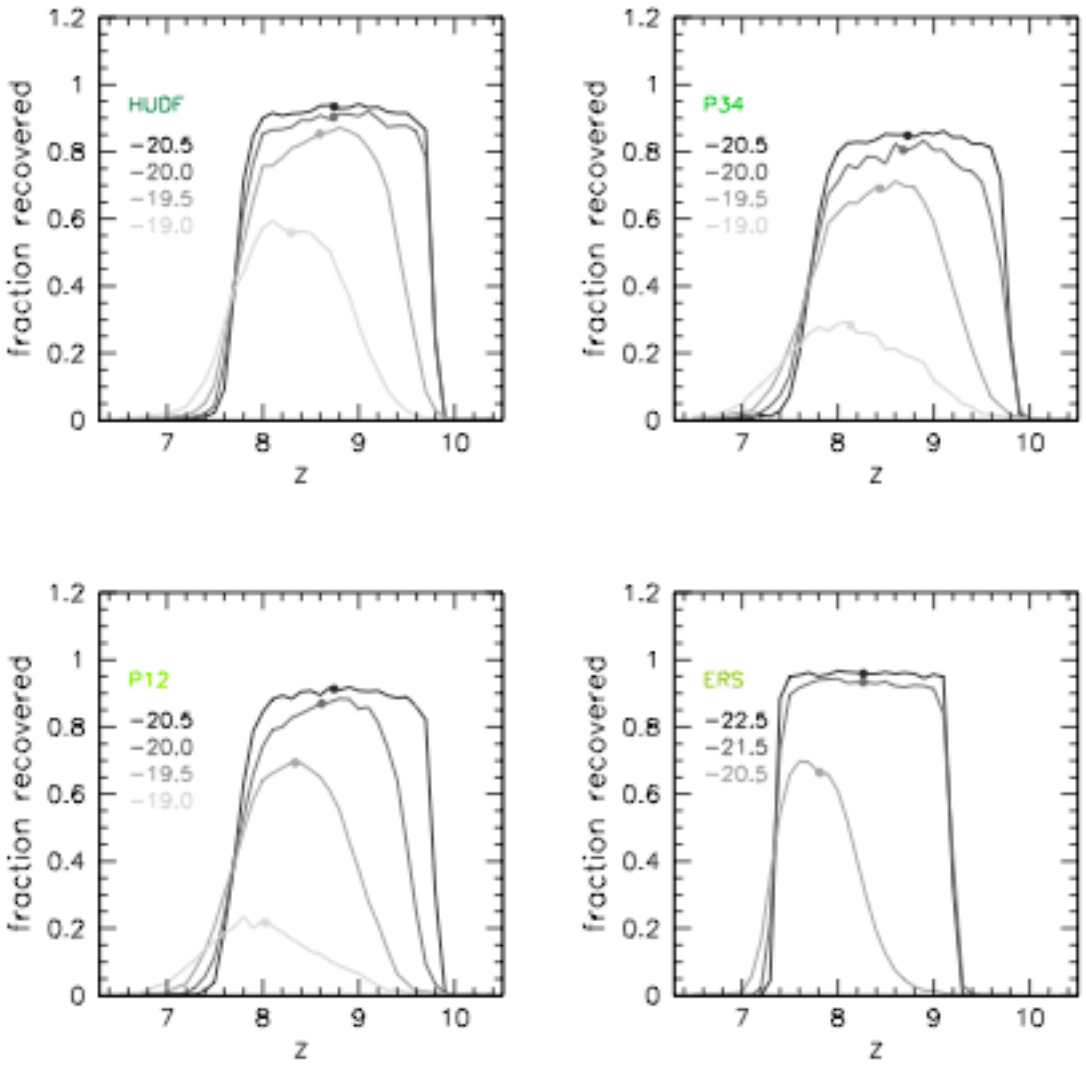
Selection criteria



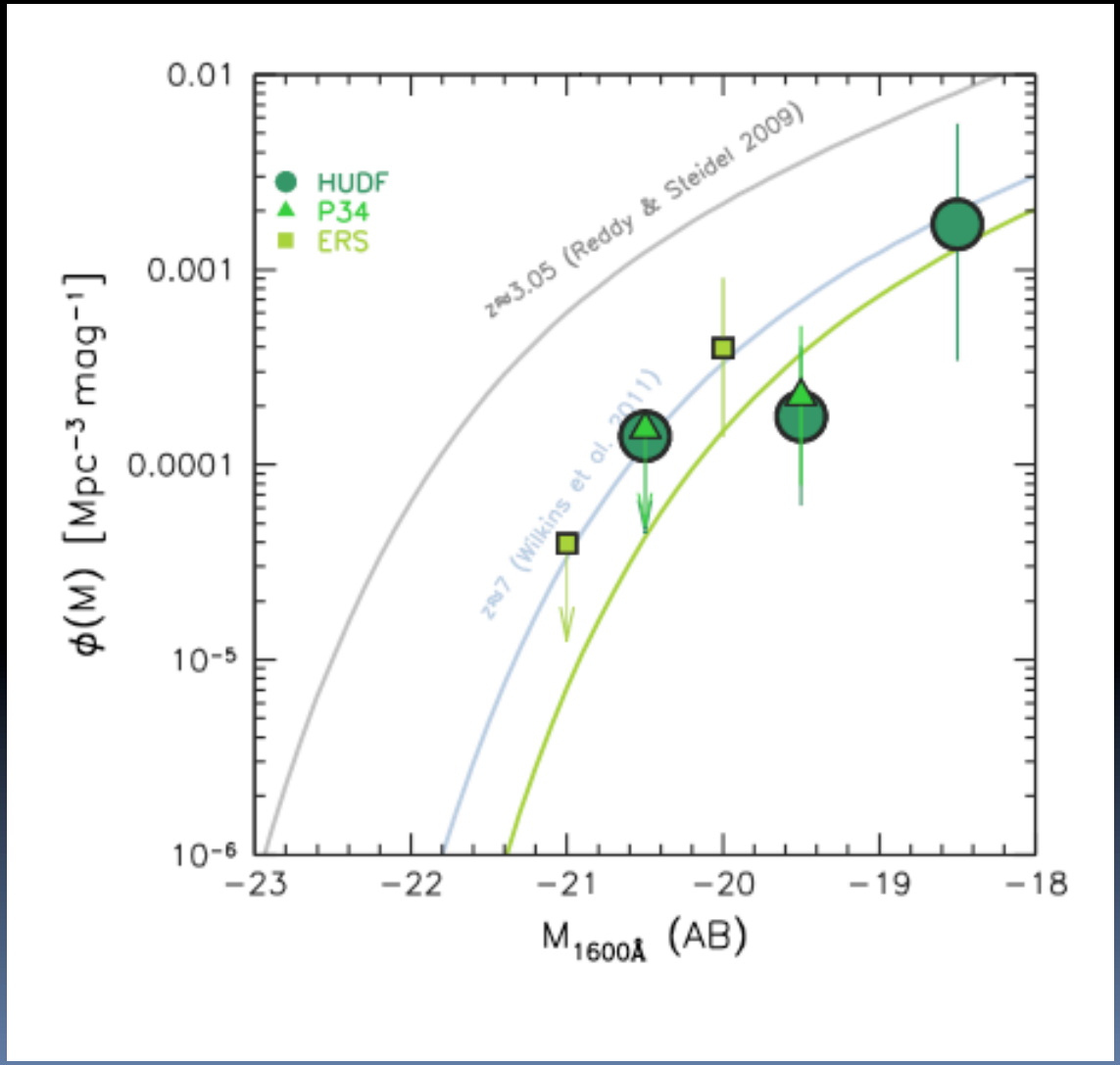
- $J_{AB} > 6\sigma$
- signal in b, v, i, z-band $< 2\sigma$
- $Y - J > 0.9$
- $Y - J > 0.73 \times (J - H) + 0.9$
- $J - H < 1.5$

Lorenzoni et al. (2011), MNRAS, 414, 1455

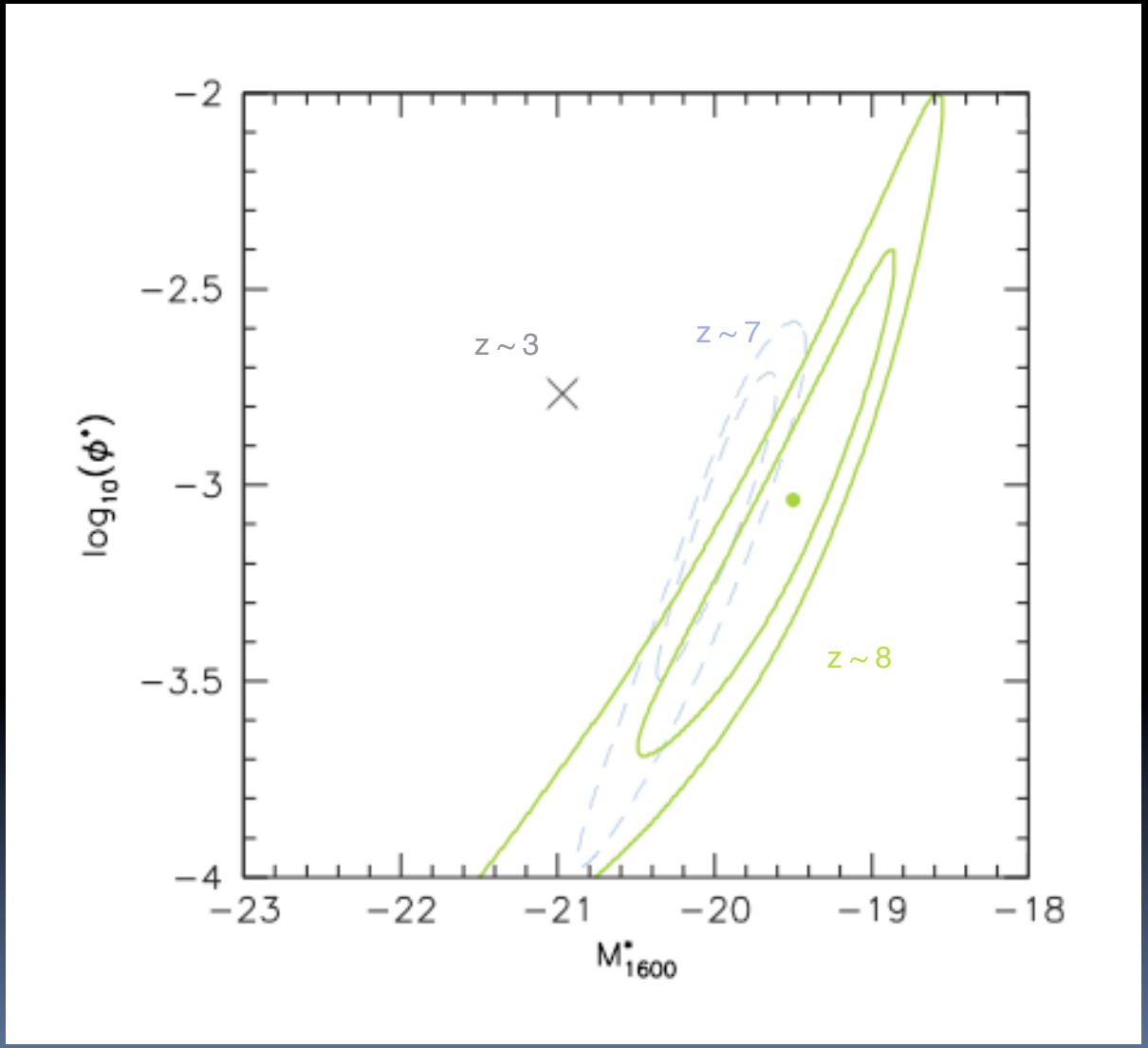

HUDF-YD2
HUDF-YD1*
HUDF-YD3
HUDF-YD4
HUDF-YD8
HUDF-YD9
P34-YD1
P34-YD2
P34-YD3
P34-YD4
P34-YD5*
P34-YD6
P34-YD7*
P12-YD1*
P12-YD2*
ERS-YD1
ERS-YD2*
ERS-YD3
ERS-YD4
ERS-YD5*
ERS-YD6
ERS-YD7*
ERS-YD8*
ERS-YD9*


HUDF
−20.5
−20.0
−19.5
−19.0
P34
−20.5
−20.0
−19.5
−19.0
P12
−20.5
−20.0
−19.5
−19.0
ERS
−22.5
−21.5
−20.5
fraction recovered
z
0
0.2
0.4
0.6
0.8
1
1.2
7
8
9
10

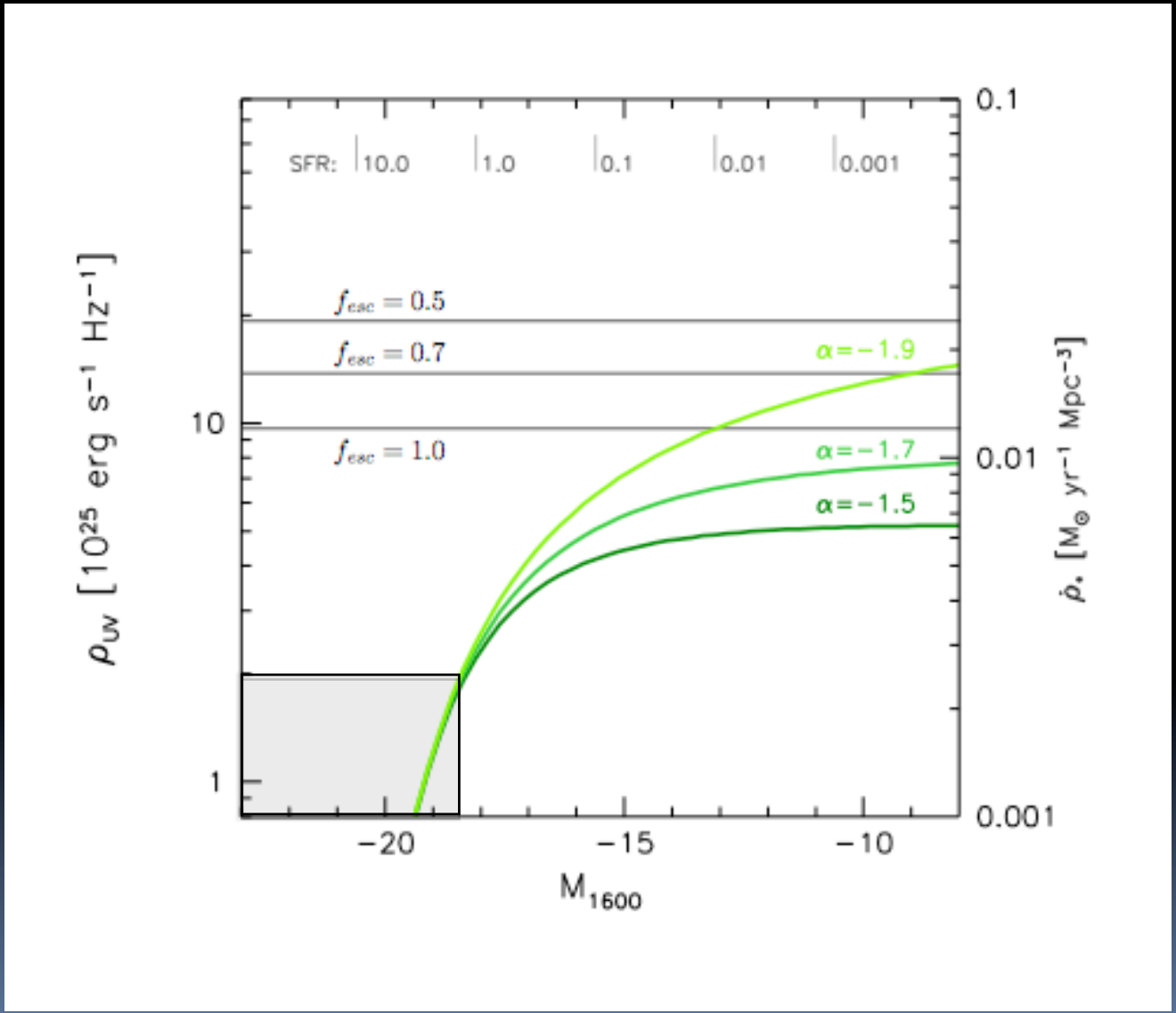
Luminosity Function…



…and its evolution



Implications for Reionization



Conclusions

LF evolution:

- clear from z=3
- evidence for evolution from z=6-7 to z=8-9
- both in phi and M*
- not enough data to constrain faint end slope.

Reionization:

- candidates we detect have insufficient flux for reionization, but a steep faint end slope, low metallicity population and a top heavy IMF could all be factors that might provide enough ionizing photons

Future

Spectroscopic confirmation of candidates (ongoing), Joseph Caruana

More data (CANDELS program)

(in case you didn't notice, it's over)

WFC3 exposure times, in ksec (number of exposures).

Field ID	Y-band[a]	J-band	H-band	J_{AB} $7\,\sigma$ limit
HUDF	28.1 (20)	44.8 (32)	75.8 (54)	28.65
P34	28.1 (20)	39.3 (28)	47.7 (34)	28.33
P12	16.8 (12)	33.7 (24)	5.6 (4)	28.22
ERS	2.6 (6)	2.6 (6)	2.6 (6)	27.16

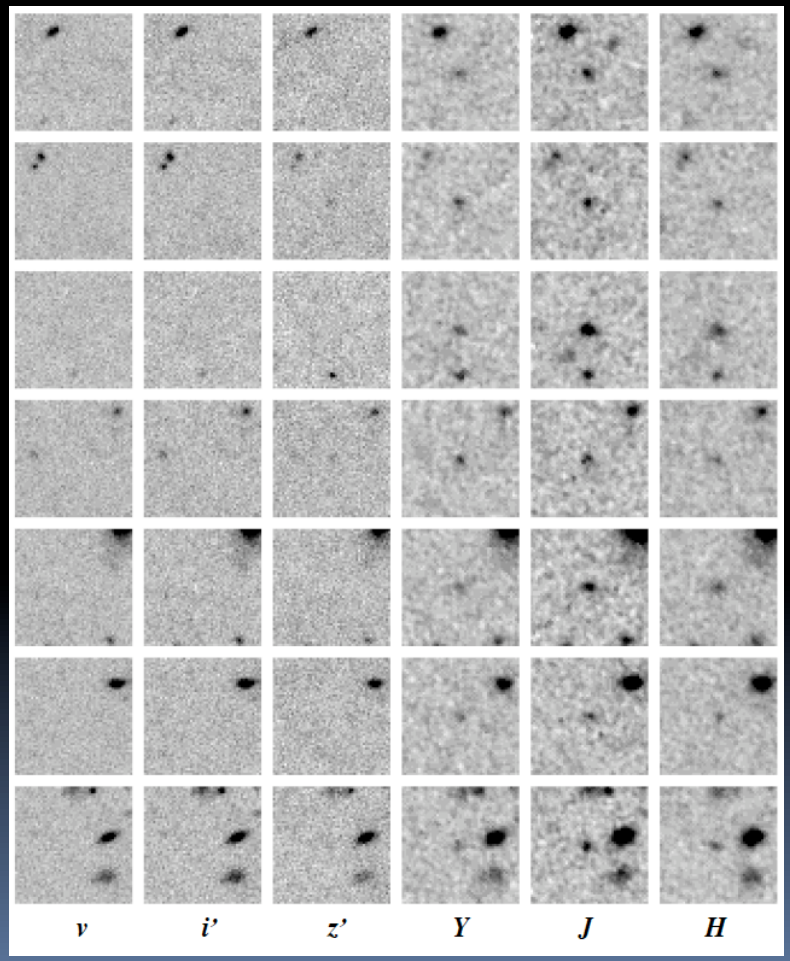
[a] Y_{098m} for the ERS fields and Y_{105w} for the HUDF/P12/P34 fields.

Table 1. The total exposure time (in ksec) is listed for each filter, with the number of individual exposures given in parentheses. The final column gives the $7\,\sigma$ magnitude limit in the J-band.

α	M^*_{1600} [AB mag]	ϕ^* [Mpc^{-3}]	ρ_{1600} [10^{25} erg s^{-1} Mpc^{-3} Hz^{-1}] ($\dot{\rho}_*$ [M$_\odot$ yr^{-1} Mpc^{-3}])		
			$M_{1600} < -18.5$ (SFR $> 1.5\,M_\odot\,yr^{-1}$)	< -13 ($> 0.01\,M_\odot\,yr^{-1}$)	< -8 ($> 10^{-4}\,M_\odot\,yr^{-1}$)
-1.5	-19.34	0.00117	1.65 (0.0022)	4.61 (0.0060)	4.88 (0.0064)
-1.7	-19.5	0.00093	1.71 (0.0022)	6.22 (0.0081)	7.27 (0.0095)
-1.9	-19.66	0.00070	1.73 (0.0023)	9.05 (0.0119)	13.46 (0.0176)

Table 6. The best fit values of M^*_{1600} and ϕ^* for s Schechter function assuming fixed $\alpha \in \{-1.5, -1.7, -1.9\}$ together with the UV luminosity densities (and star formation rate densities in parentheses) determined by integrating the luminosity function down to various limiting absolute magnitudes.

Candidates



Candidates