Galaxy Surface Density and Expected Sizes at AB∼31 mag: — the View from HST

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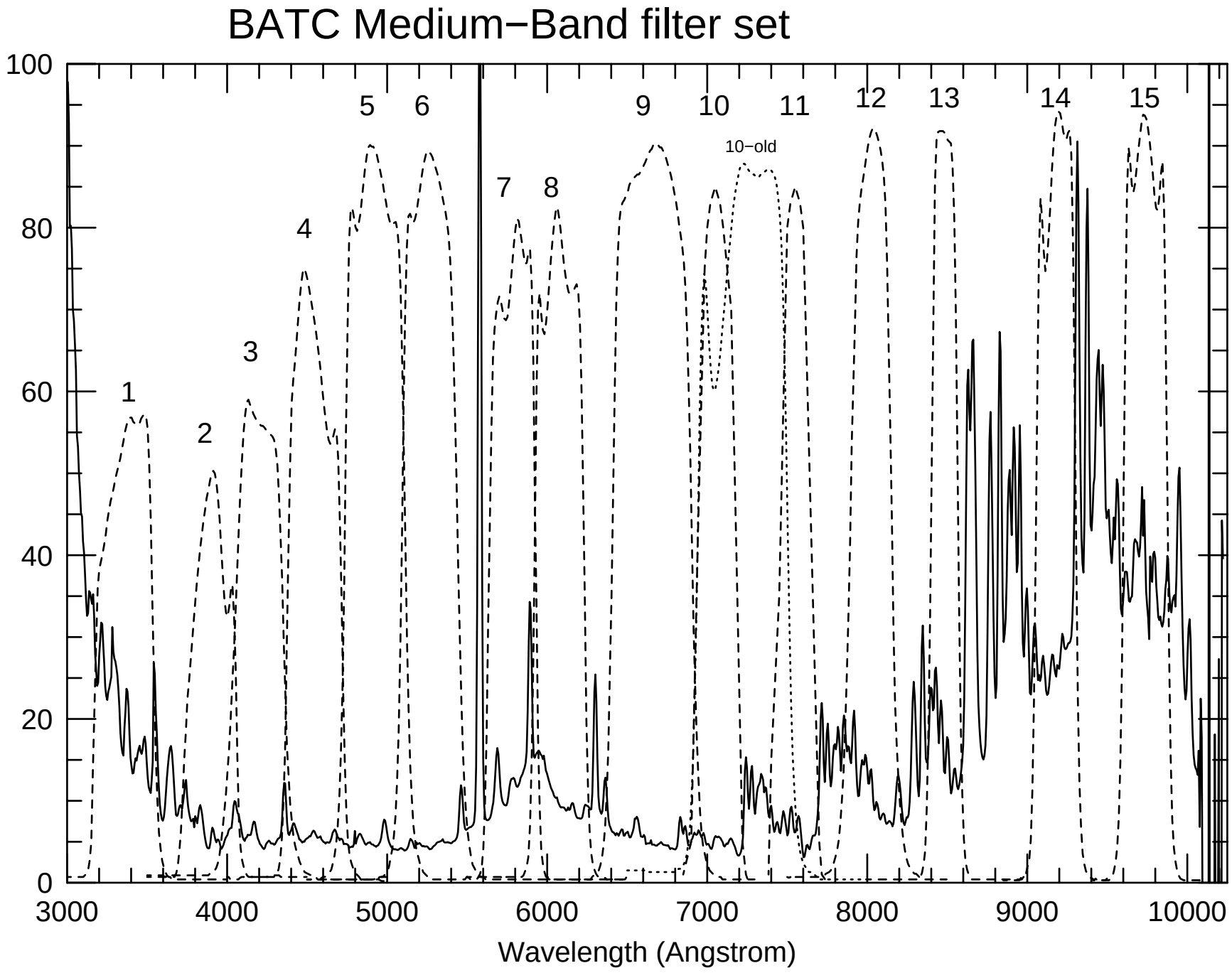
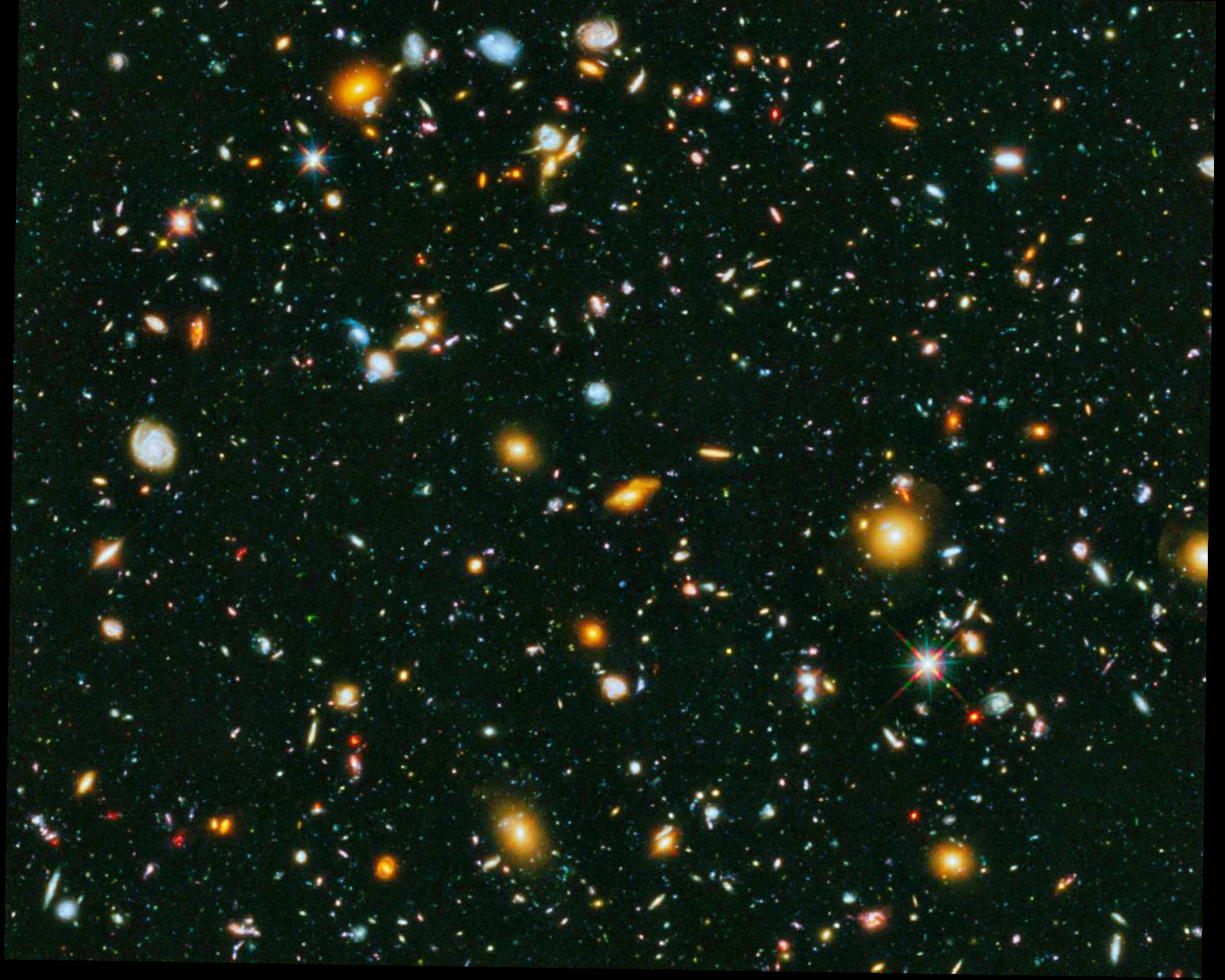
Talk at the ORCAS Science telecon (GSFC, Greenbelt, MD; via Zoom)

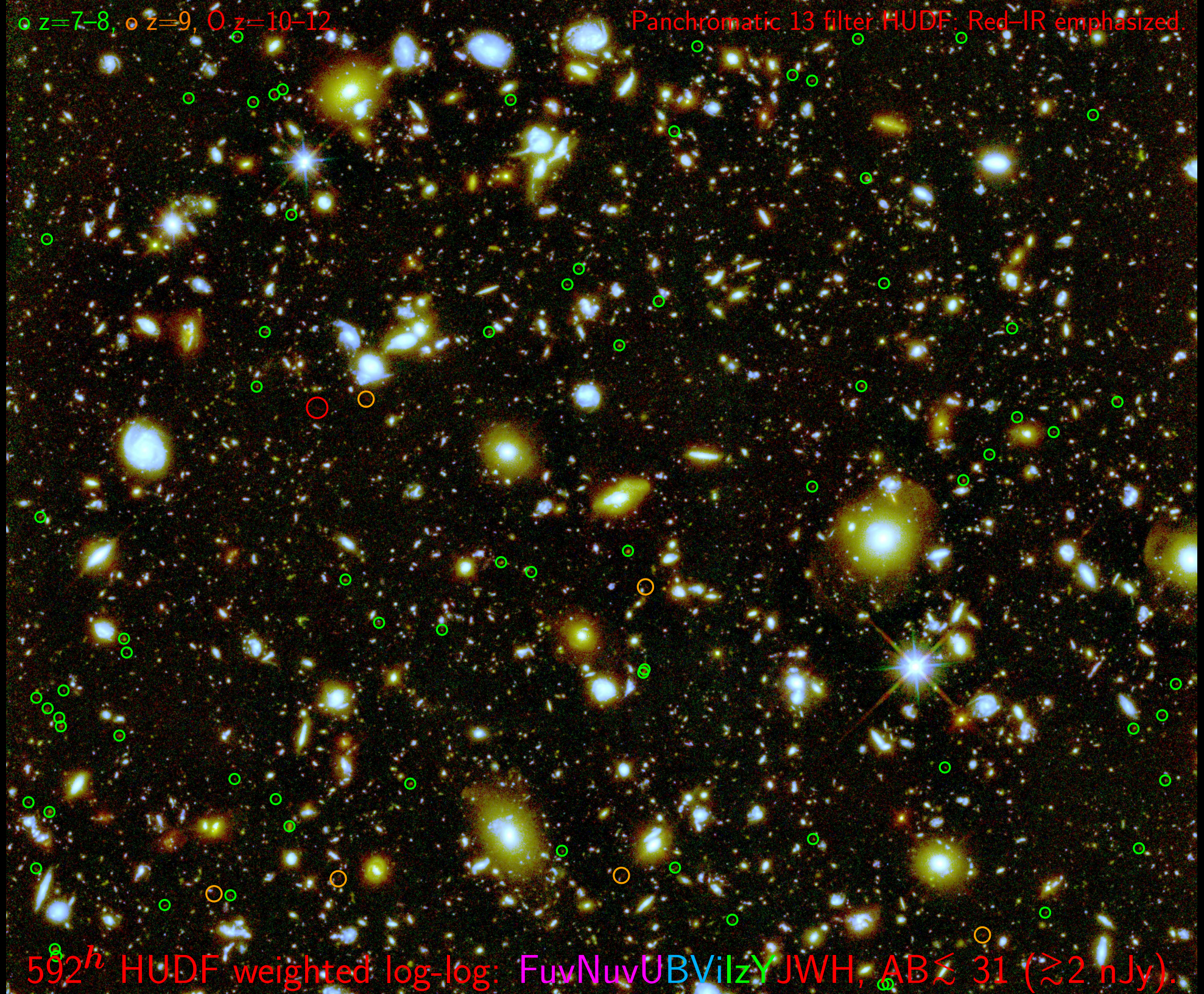

BATC Medium−Band filter set
100
80
60
40
20
0
3000
4000
5000
6000
7000
8000
9000
10000
Wavelength (Angstrom)
1
2
3
4
5
6
7
8
9
10
10−old
11
12
13
14
15

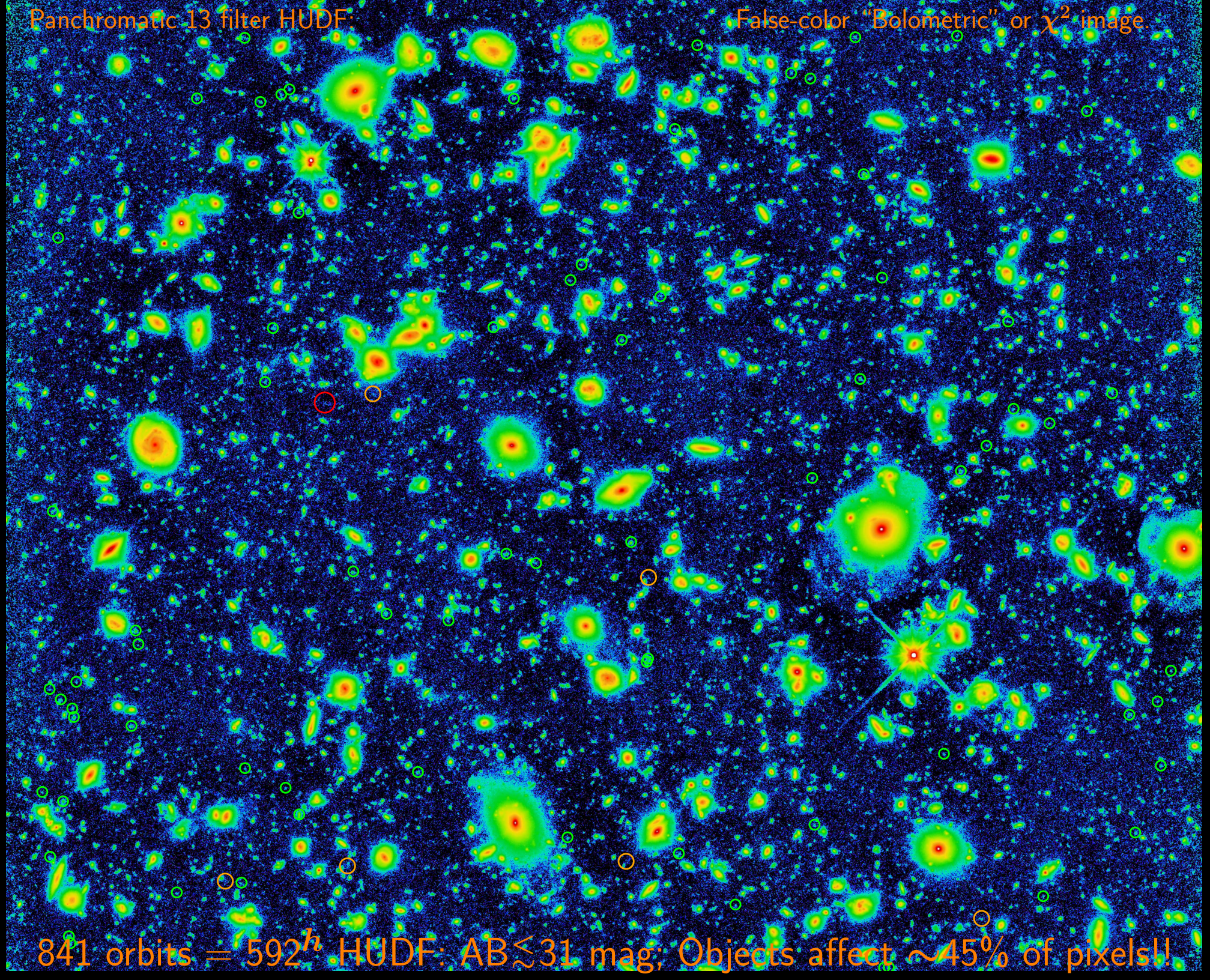
For lowest possible Keck sky, suggest to use notch filters from, e.g., the BATC survey (Yan, H., et al. 2000, PASP, 112, 691), e.g.:

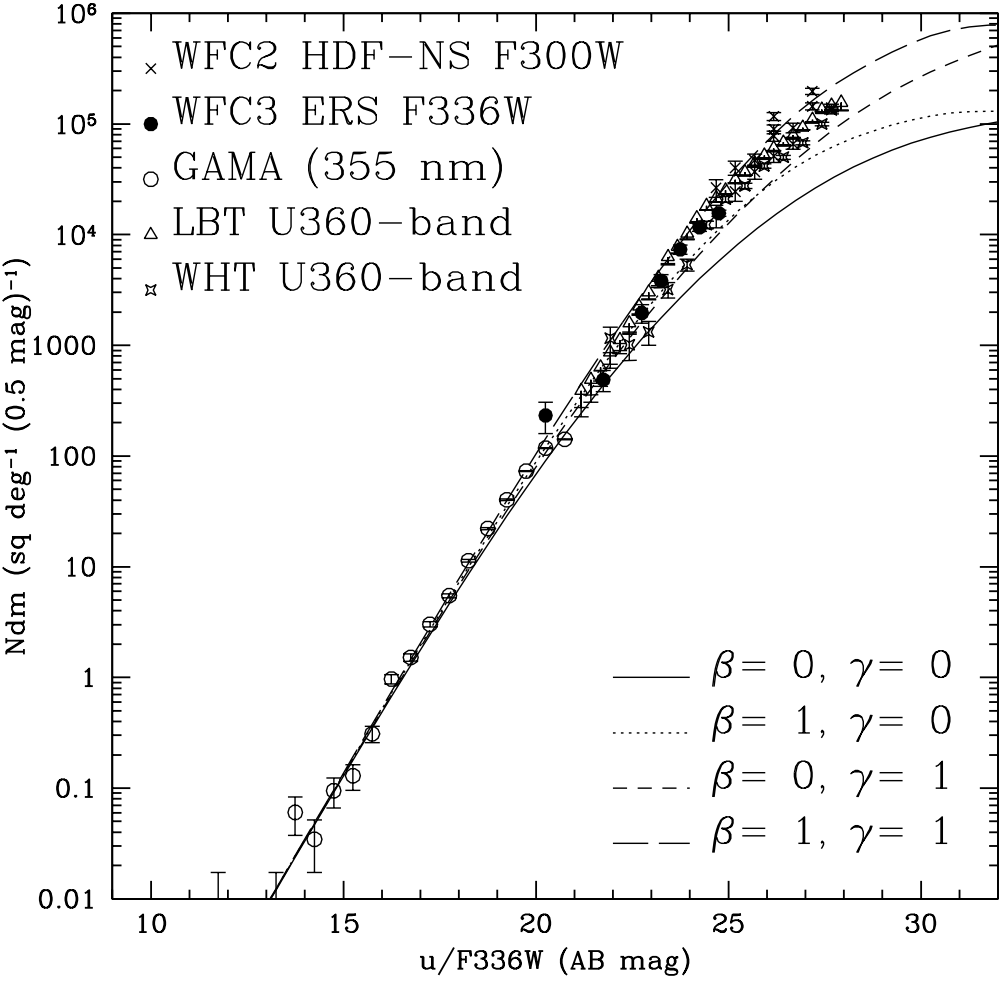
U$\simeq$1+2; B$\simeq$3+4, V$\simeq$5+6, R$\simeq$7+8, I$\simeq$9+10, Z$\simeq$11+12+13, Y$\simeq$14+15.

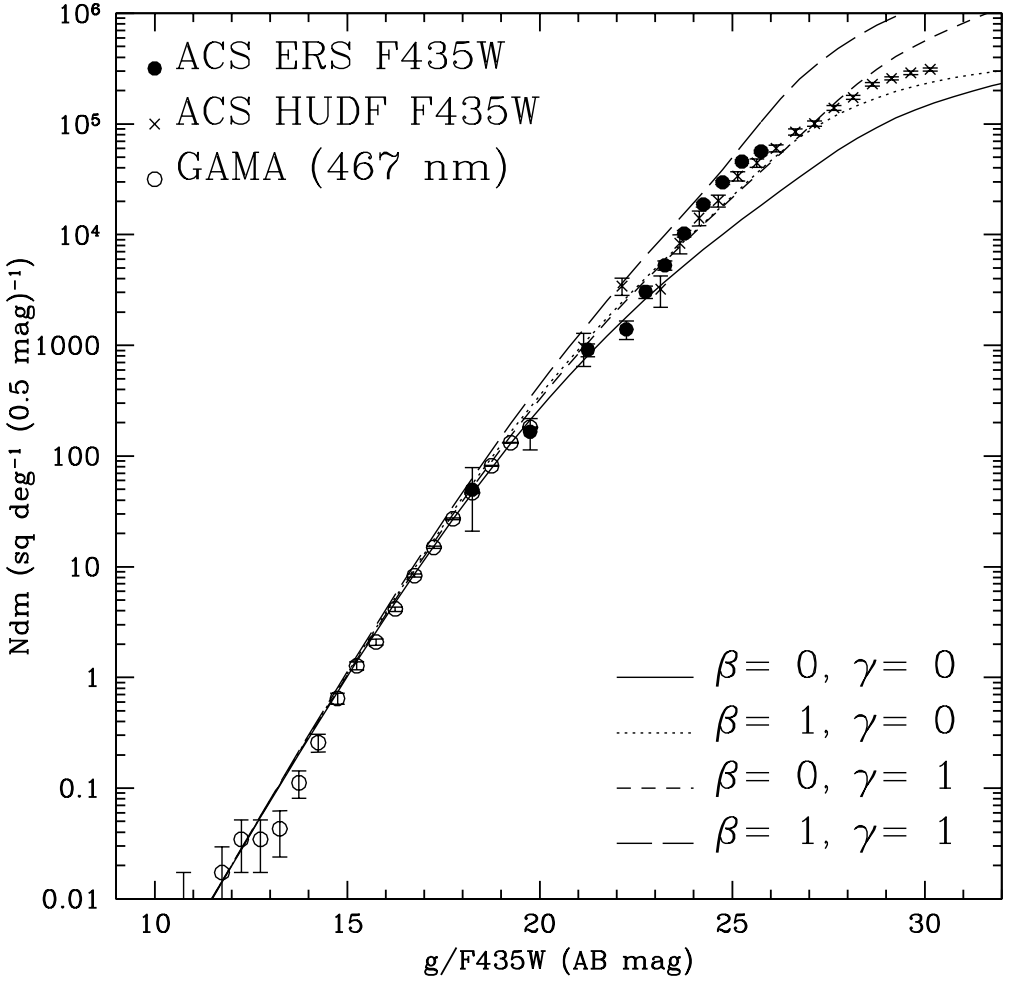
This can save you more than 1 mag in SB sensitivity from the ground, especially in the red.




z=7–8, z=9, z=10–12
Panchromatic 13 filter HUDF: Red–IR emphasized.
592^h HUDF weighted log-log: FuvNuvUBViIzYJWH, AB≲ 31 (≳2 nJy).


Panchromatic 13 filter HUDF:
False-color "Bolometric" or χ^2 image
841 orbits $=592^h$ HUDF: AB$\lesssim$31 mag; Objects affect $\sim$45% of pixels!!

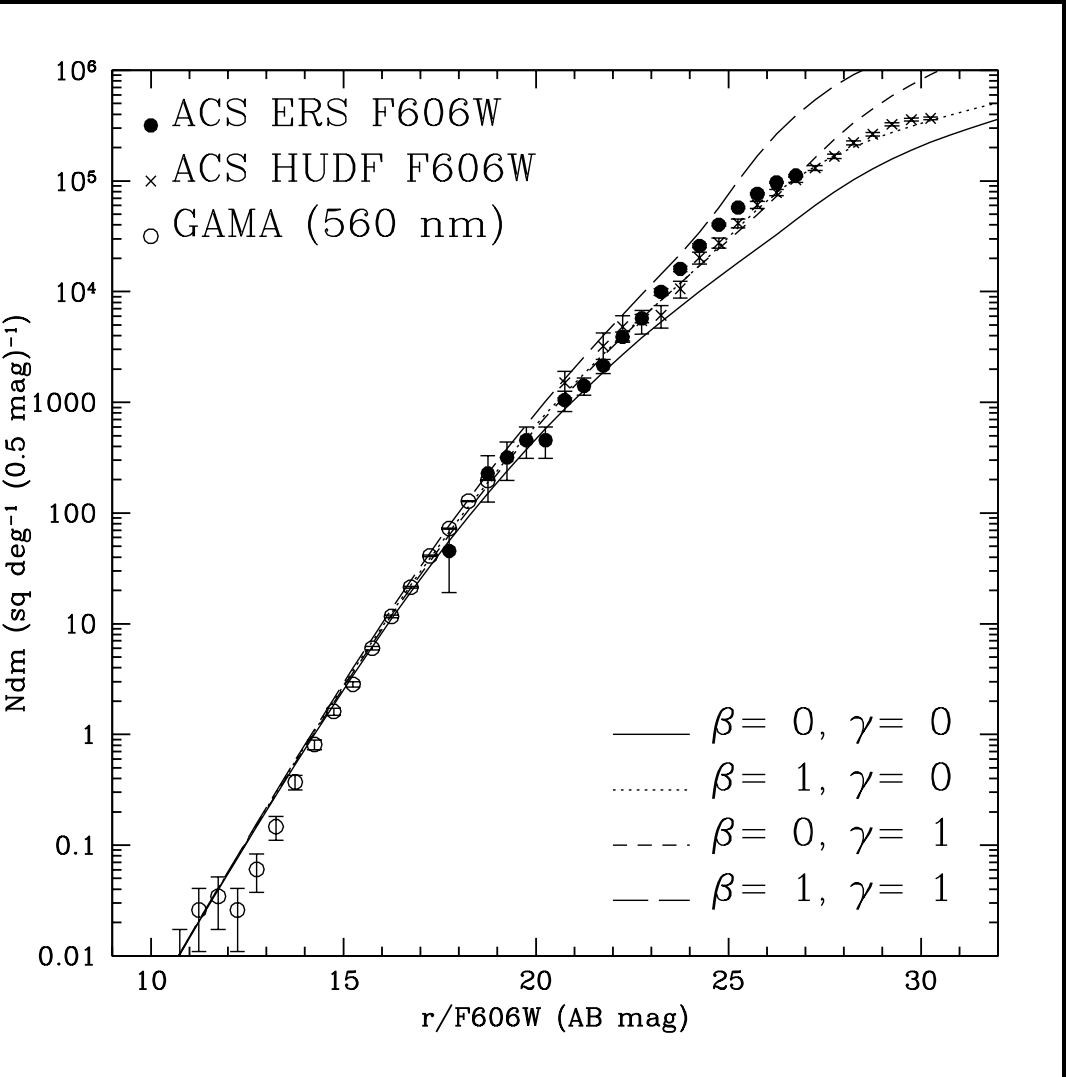


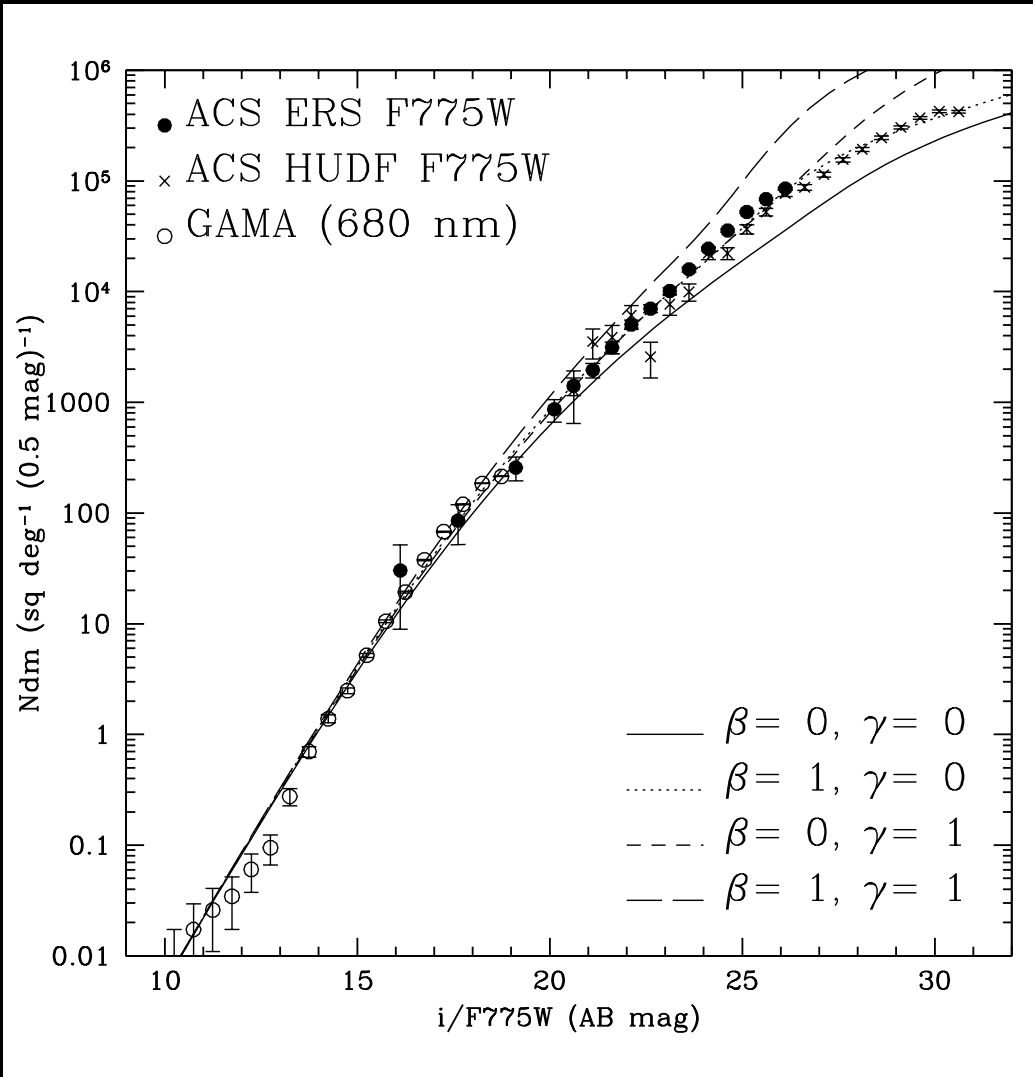


U-band and B-band galaxy counts (Windhorst^{+}2011).

Faint-end blue count-slope$\simeq$0.35–0.40 dex/mag.

Integrated surface density at AB$\lesssim$31 mag: 3×10^{6}–1.8×10^{6} deg^{-2} .

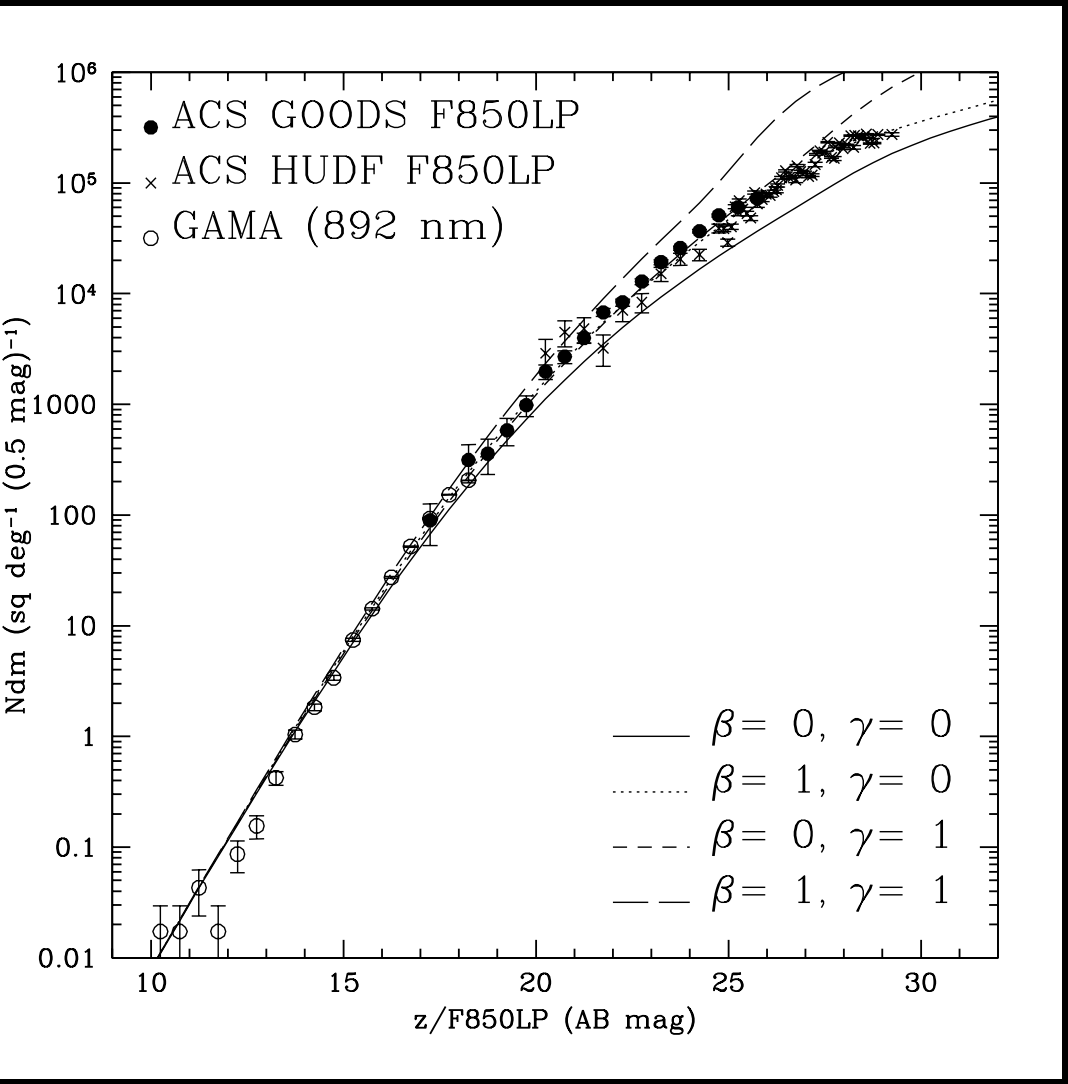


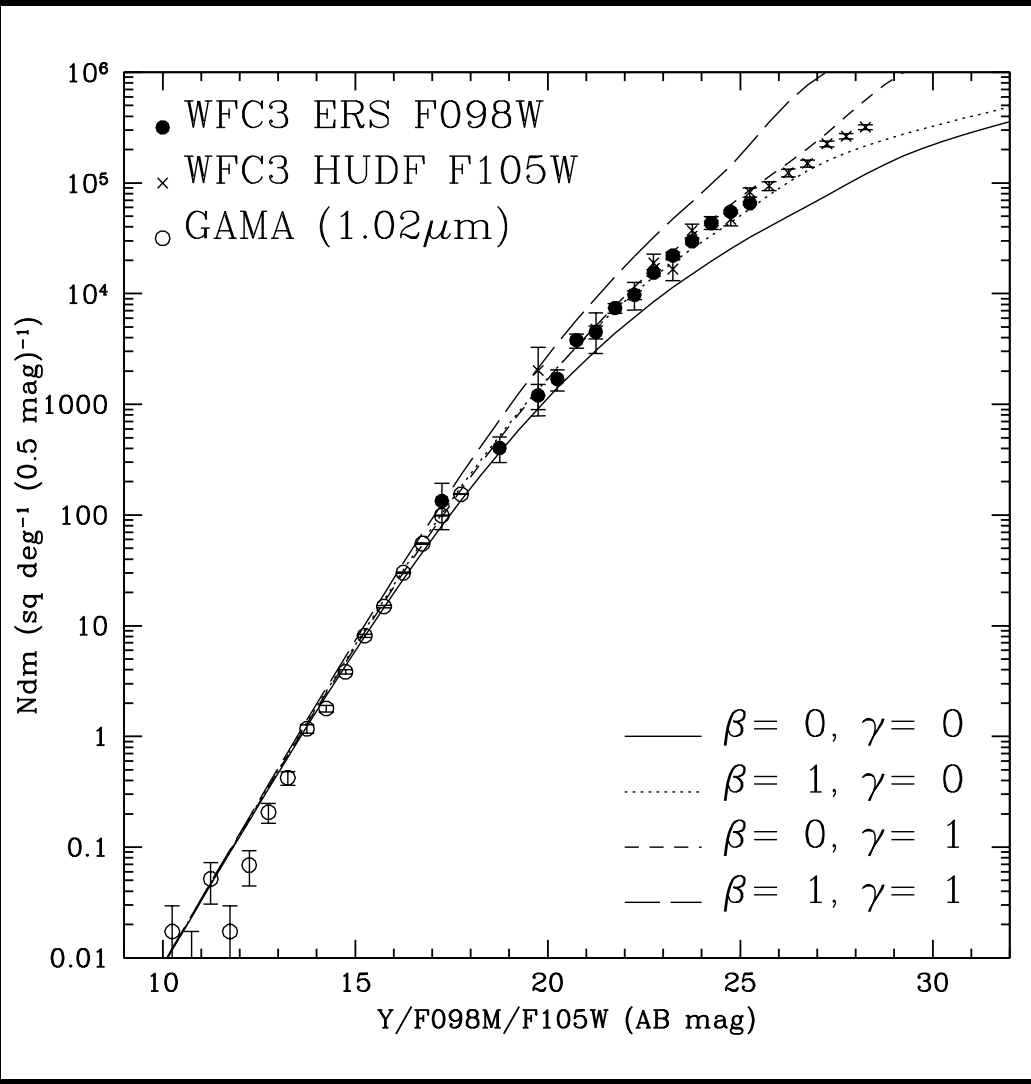


V-band and i-band galaxy counts (Windhorst^{+}2011).

Faint-end green-orange count-slope$\simeq$0.25–0.30 dex/mag.

Integrated surface density at AB$\lesssim$31 mag: 2.7×10^{6}–3×10^{6} deg^{-2} .

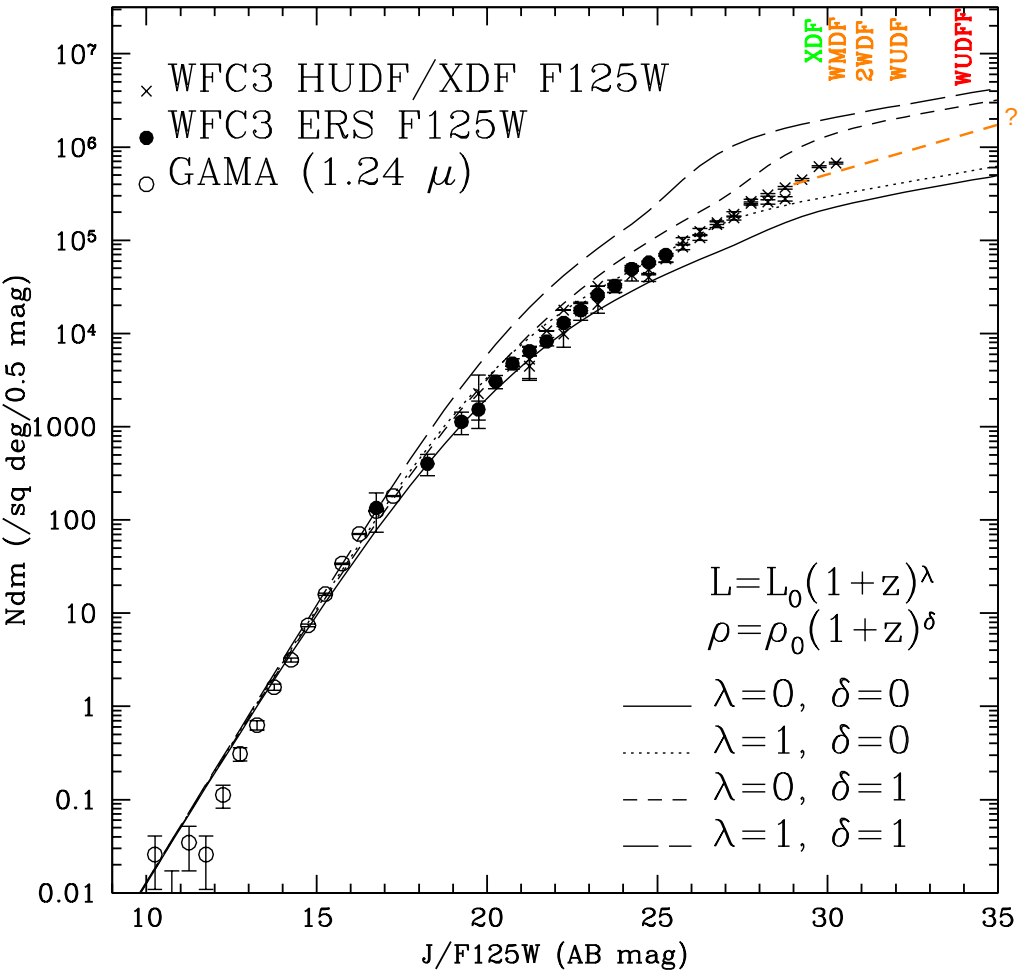


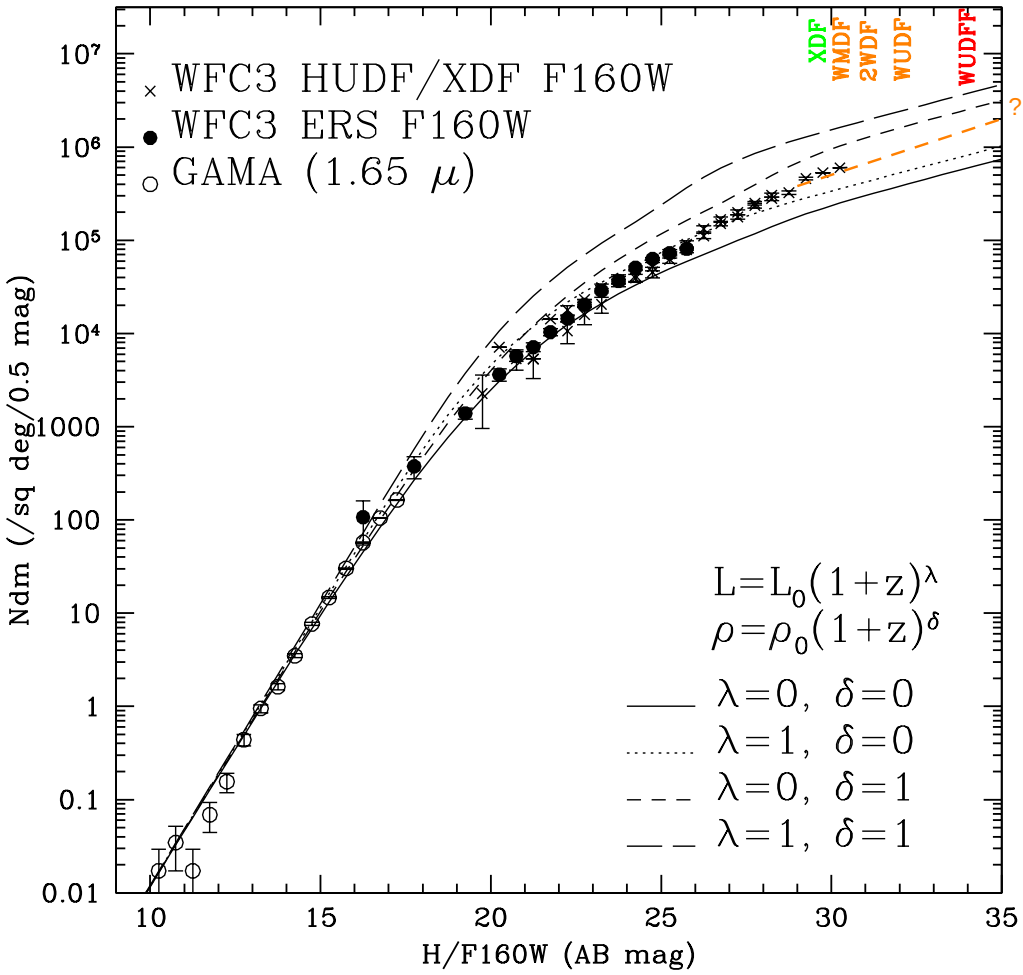


z-band and Y-band galaxy counts (Windhorst^{+}2011).

Faint-end red count-slope$\simeq$0.25 dex/mag.

- Integrated surface density at AB$\lesssim$31 mag: 2.7×10^{6}–3×10^{6} deg^{-2} .





J-band and H-band galaxy counts (Windhorst^{+}2011).

Faint-end near-IR count-slope$\simeq$0.12$\pm$0.02 dex/mag.

Integrated surface density at AB$\lesssim$31 mag: 4.2×10^{6} deg^{-2} .

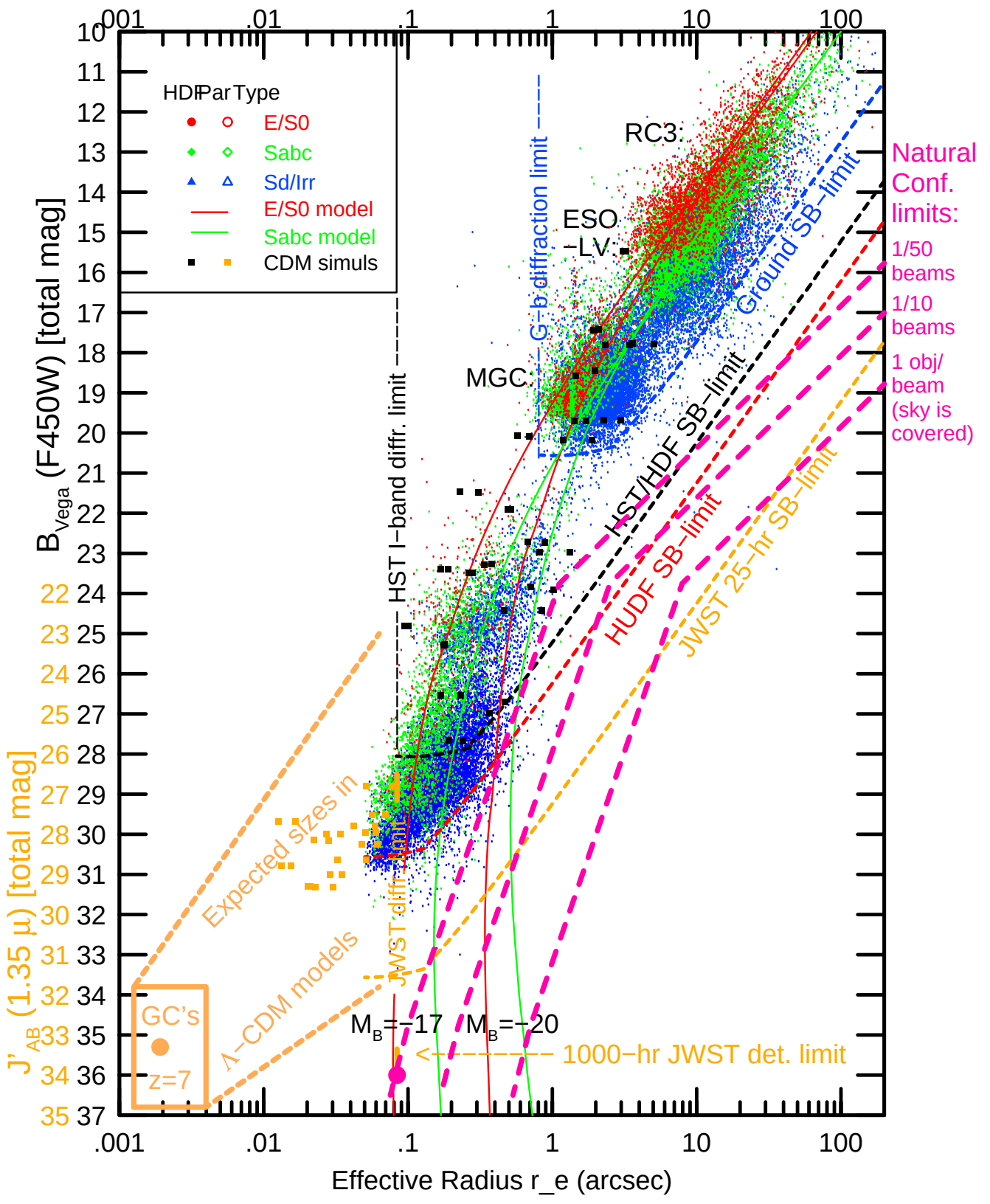
B, I, J AB-mag vs. half-light radii r_e from RC3 to HUDF limit are shown.

All surveys limited by by SB (+5 mag dash)

Deep surveys bounded also by object density.

Violet lines are gxy counts converted to to natural conf limits.

SB$\lesssim$31 mag objects are likely globular or compact star clusters. with FWHM$\gtrsim$0$''$.012



Combination of ground-based and space-based HST surveys show:

- (1) Apparent galaxy sizes decline from the RC3 to the HUDF limits:

- (2) At the HDF/HUDF limits, this is not only due to SB-selection effects (cosmological $(1+z)^4$-dimming), but also due to:

- (2a) hierarchical formation causing size evolution:
  $r_{hl}(z) \propto r_{hl}(0)\ (1+z)^{-1}$

- (2b) increasing inability of object detection algorithms to deblend galaxies at faint mags ("natural" confusion $\neq$ "instrumental" confusion).

- (3) At AB$\lesssim$31 mag, will see 2×10^6–4×10^6 galaxies/deg^2. Most of these will have $r_{hl} << 0\farcs1$ FWHM (Kawata et al. 2006).

- (4) At ORCAS FWHM$\sim0\farcs012$ (5 m.a.s. pixels), expect some fraction (10%?) to be point sources — globular clusters or compact star clusters? Exact number will require higher-resolution hierarchical simulations.

- For details, see Windhorst, R. A., et al. 2008, Advances in Space Research, Vol. 41, 1965, (astro-ph/0703171) or Windhorst et al. 2011, ApJS, 193, 27 (astro-ph/1005.2776).