

$z = 8$ Ly α emitters

J.G. Cuby, LAM

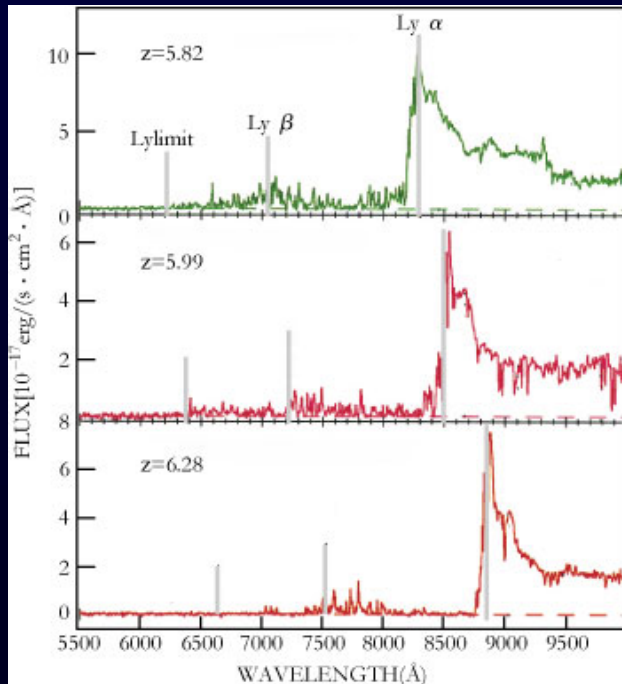
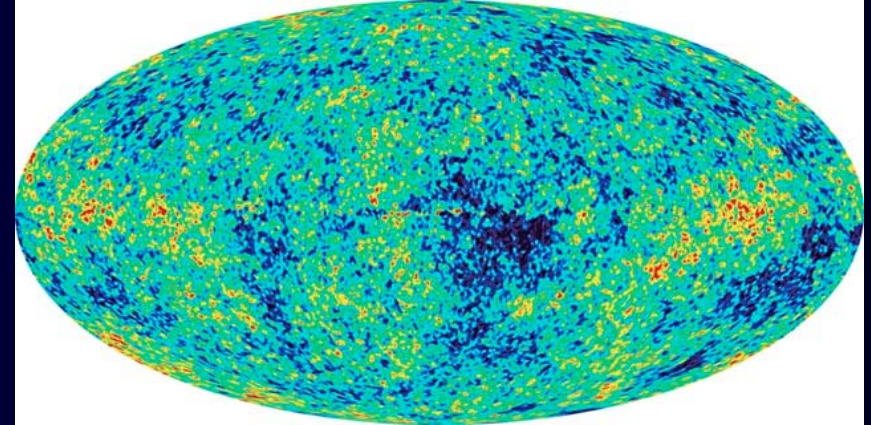
P. Hibon, LAM, ESO

High z Ly α emitters

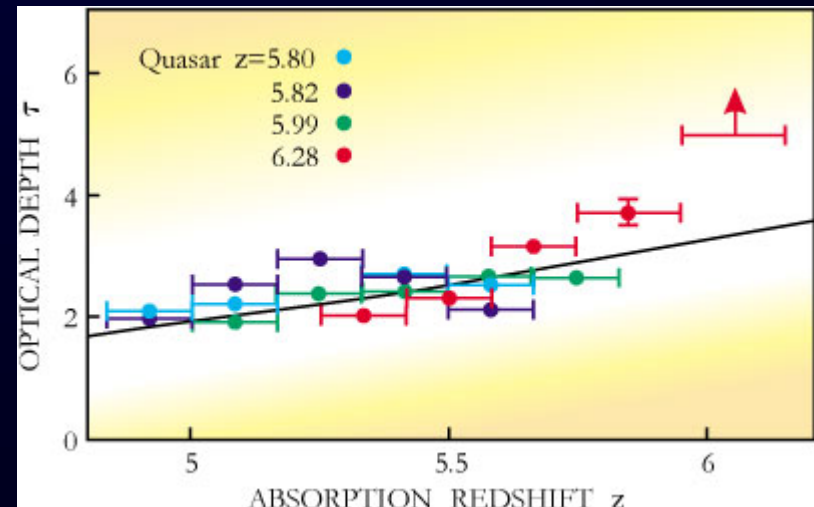
- When did the first galaxies form ?
- When did the re-ionization of the Universe occur ?
- Which were the sources responsible for this re-ionization (pop III, QSOs ?)

Ly α emitters to probe re-ionization

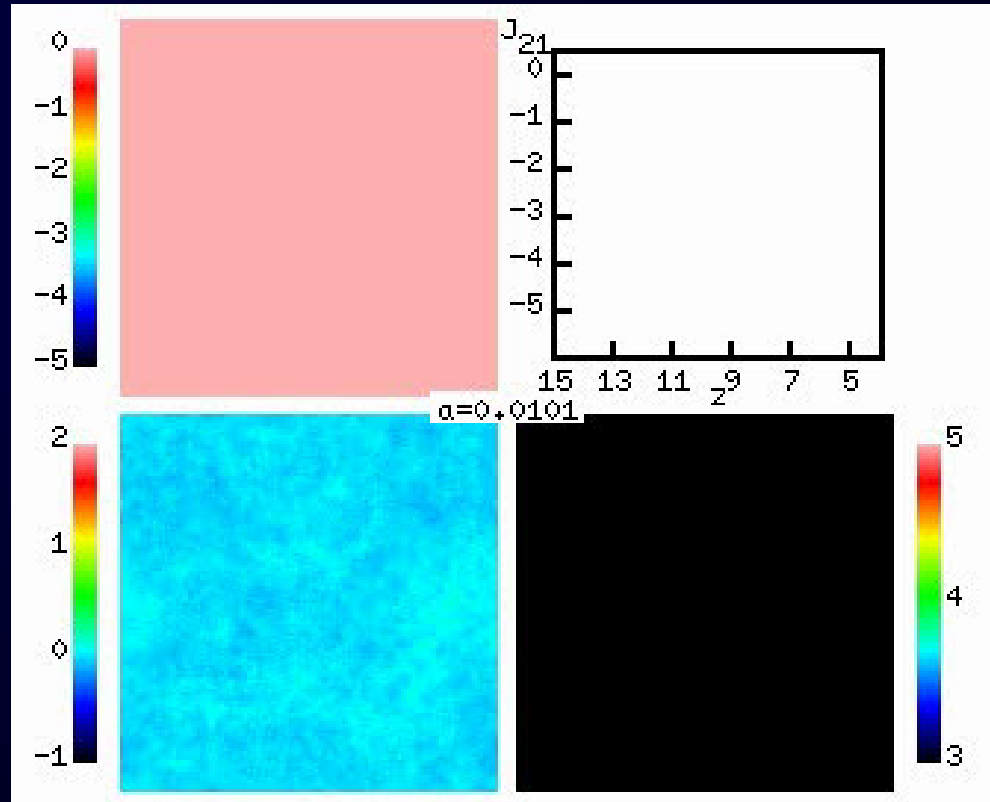
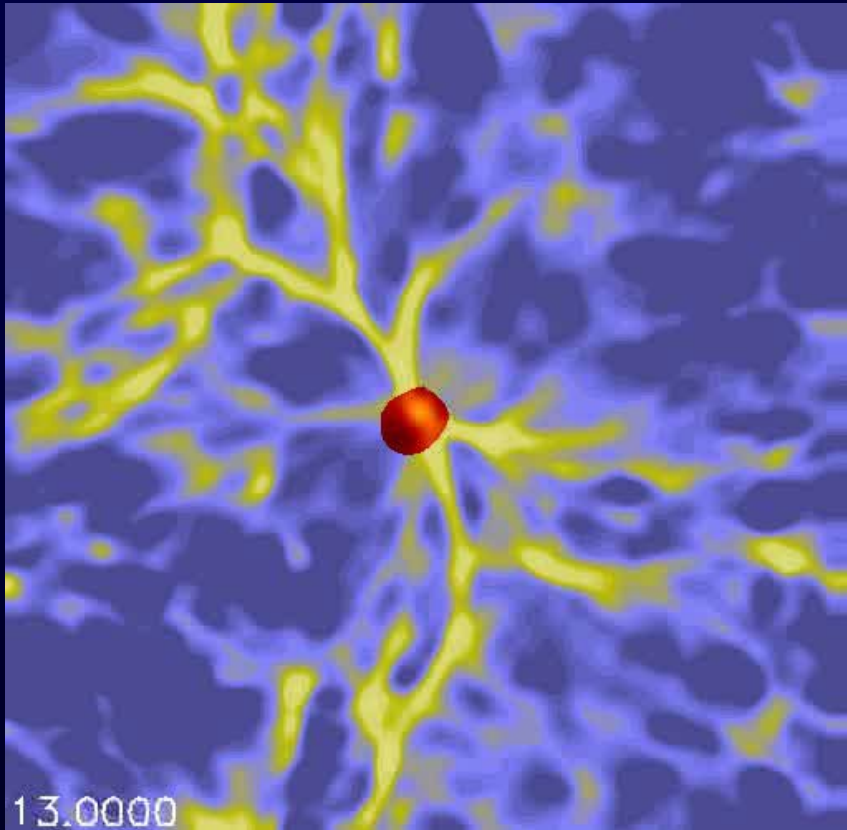
- WMAP results indicate a very early re-ionization epoch, $z \geq 15$



- Gunn-Peterson troughs in high z QSOs indicate Universe was still neutral at $z \cong 6$.



Are the two pictures consistent ?



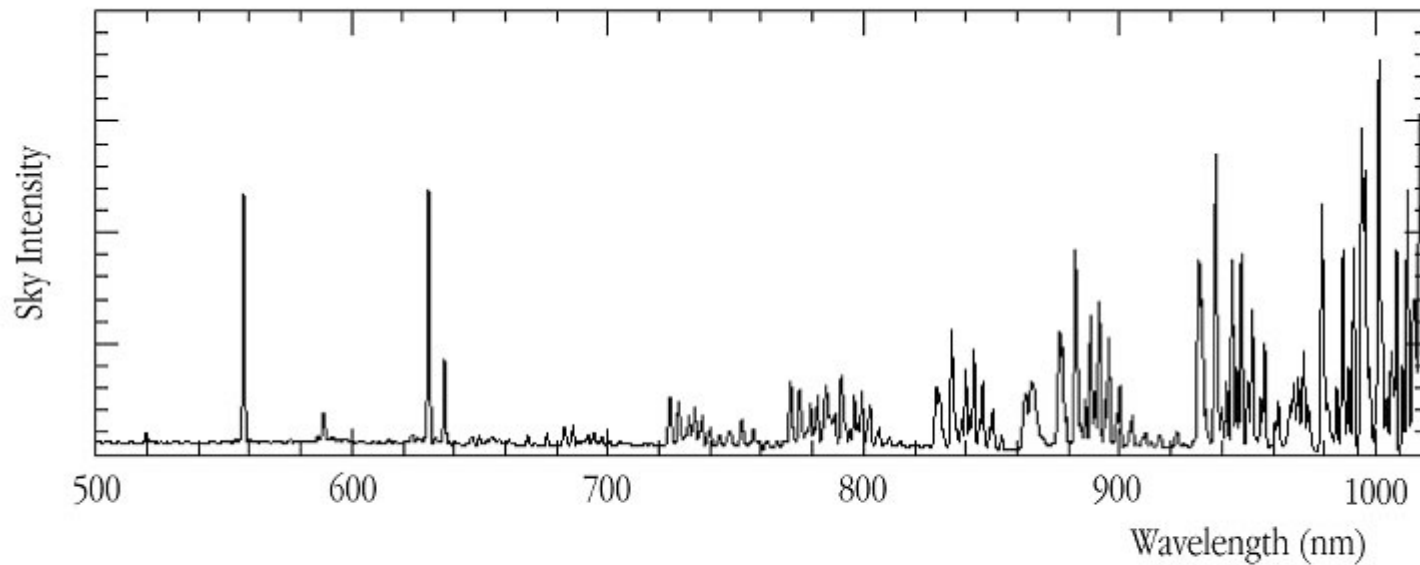
Nick Gnedin

<http://casa.colorado.edu/~gnedin>

Searching high z objects

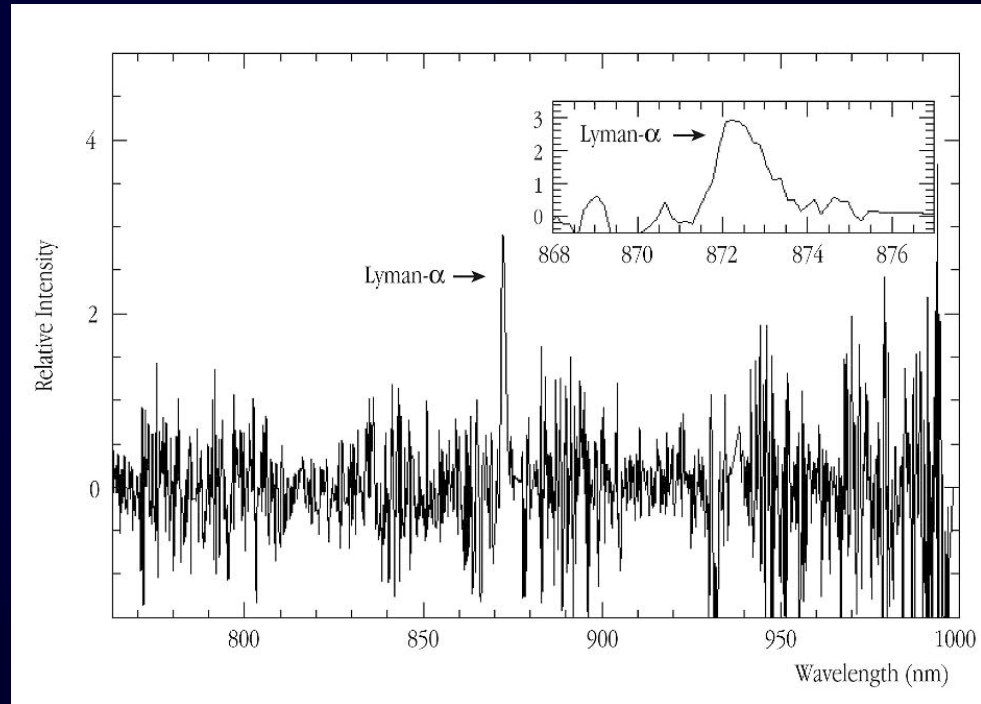
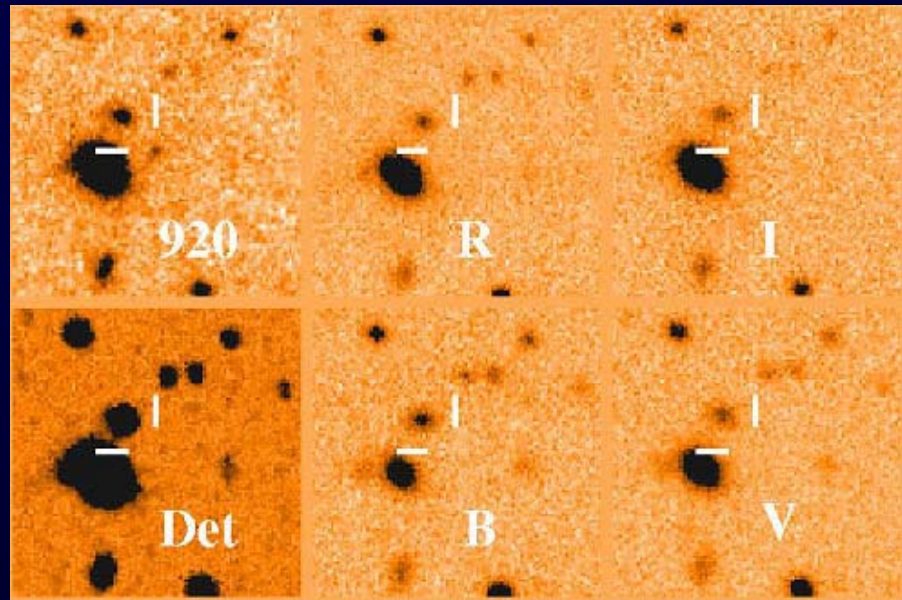
- Drop-outs, now up to $z = 7-8$ (Bouwens et al., UDF)
- Gravitational telescope (Pello et al.)
- Ly α
 - Easier detection through emission line:
 - narrow band imaging
 - multi-window spectroscopy (Lilly et al.)
 - Easy single line spectroscopic confirmation:
 - Continuum break across the line
 - Line asymmetry

Visible Domain ($< 1 \mu\text{m}$)



Emission from Terrestrial Atmosphere

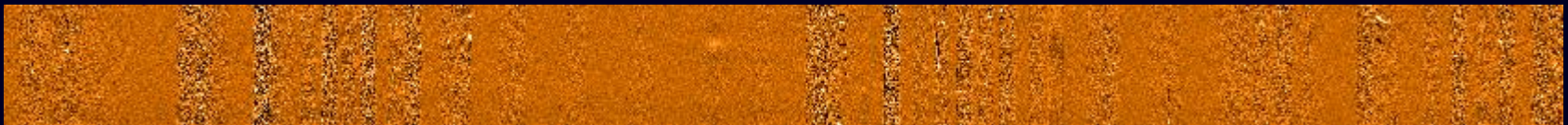
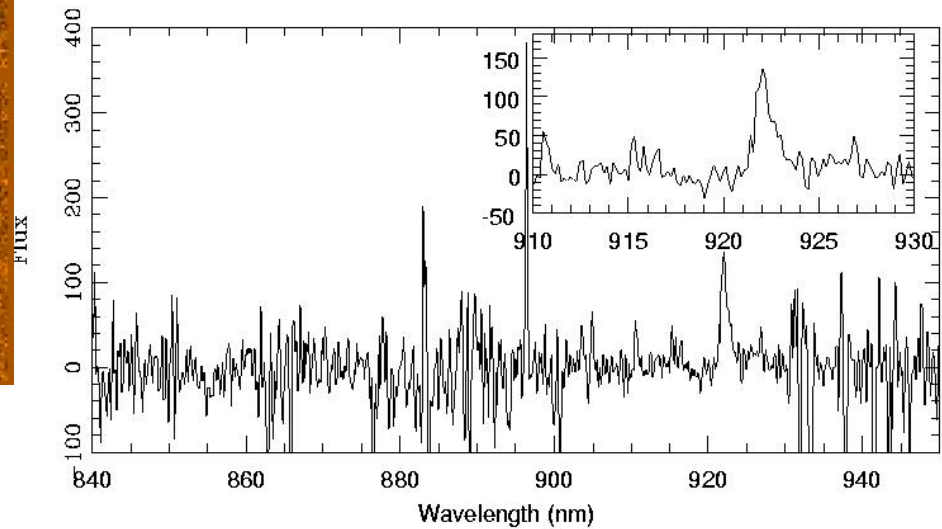
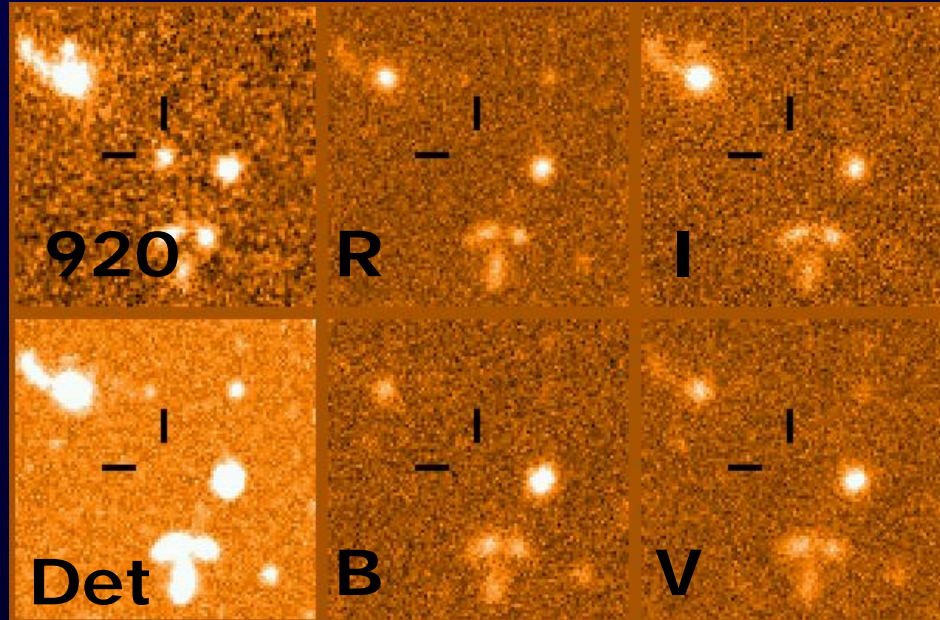
920 nm window – CFH12k



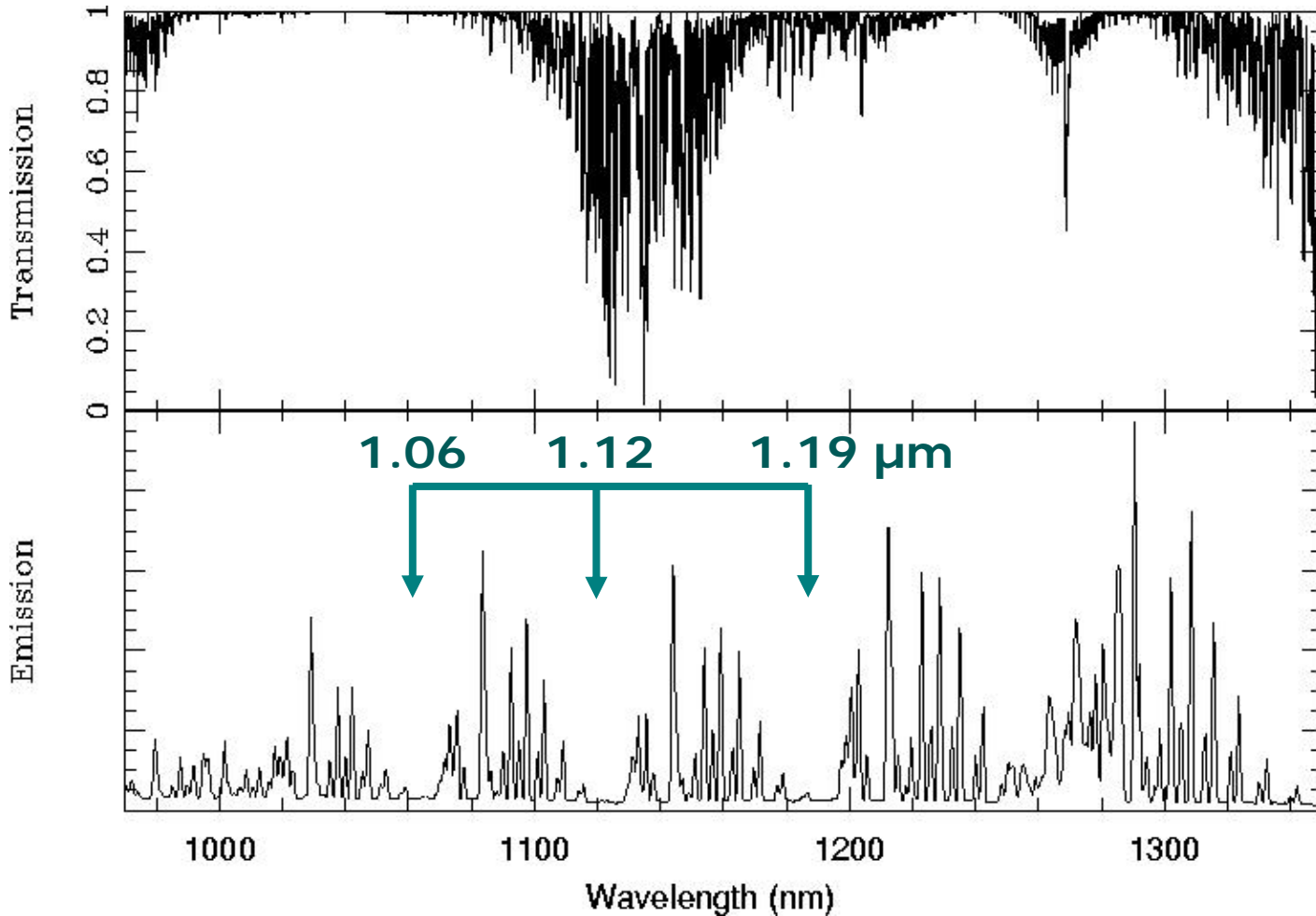
$z = 6.17$

920 nm window – CFH12k

$z = 6.58$



Near IR > 1 μm windows

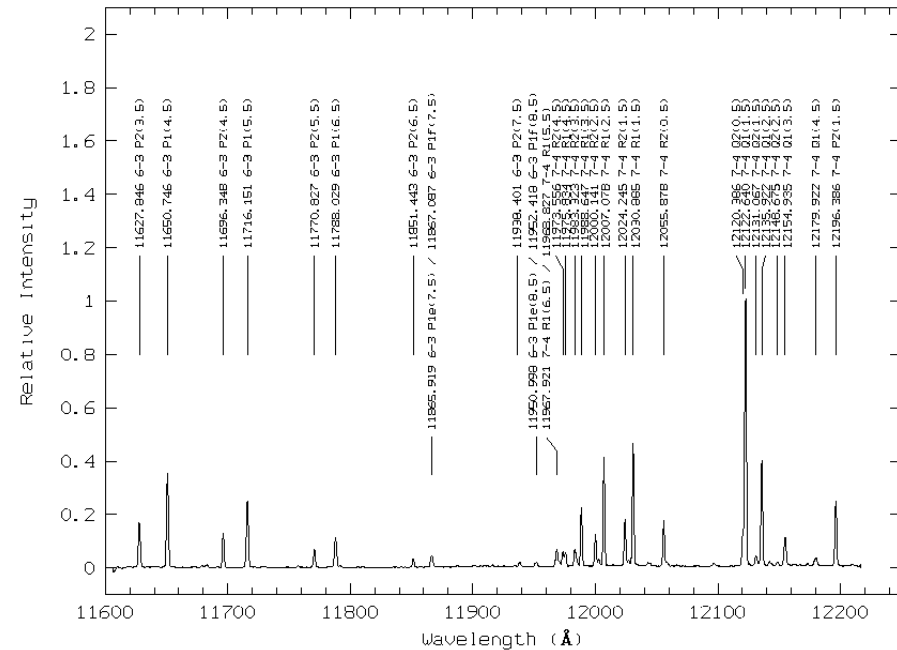
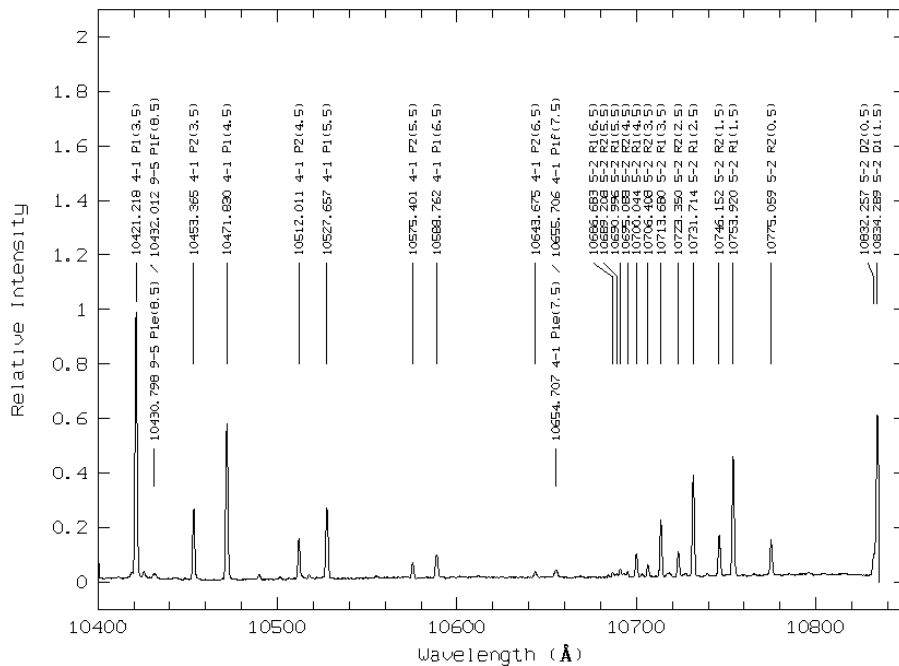


Absorption

Emission

J band

Near IR low OH windows



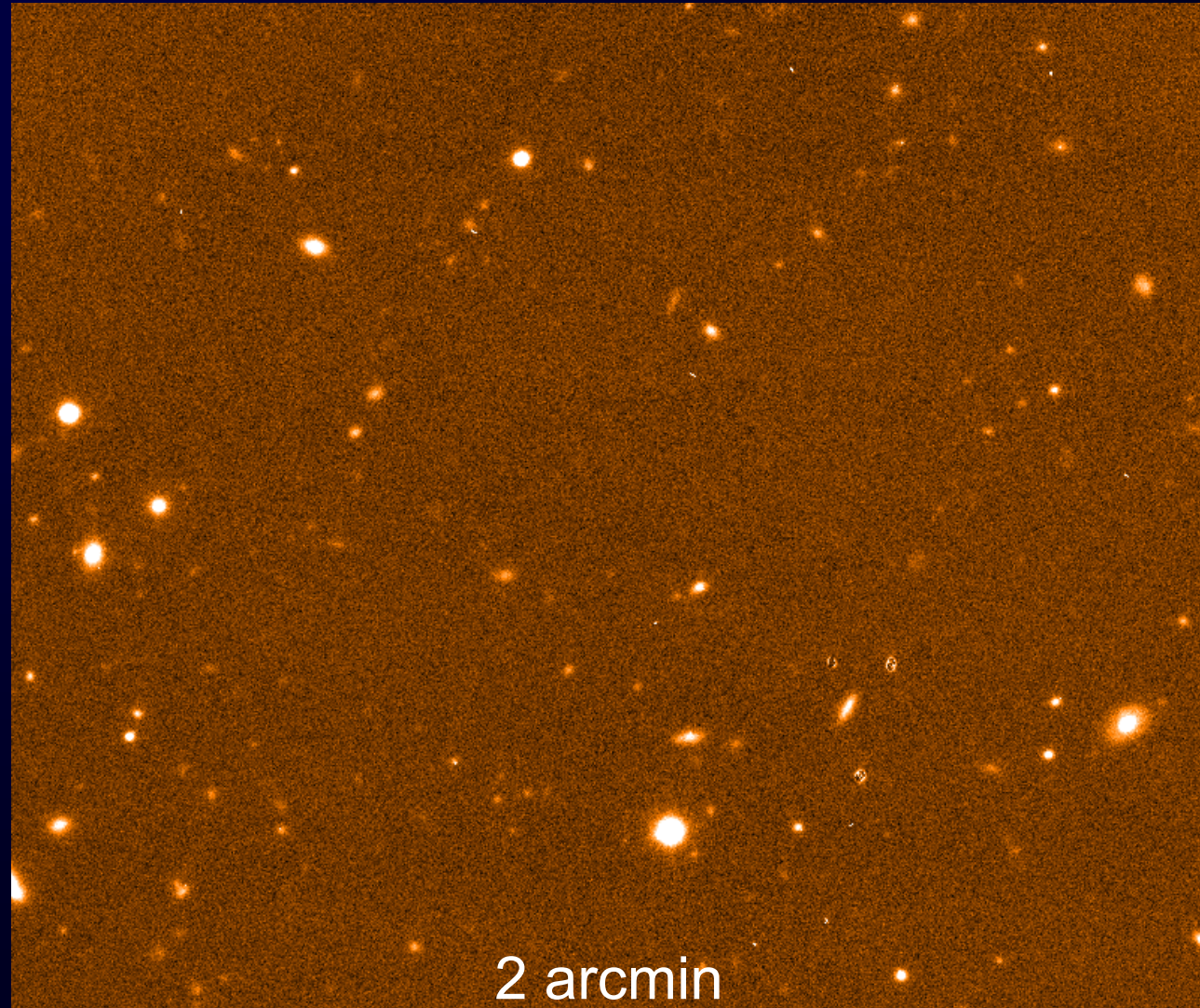
1.19 μm window, $z \sim 8.7$

$z = 8$ galaxies with WIRCAM

VLT / ISAAC
Observations
@ $1.19 \mu\text{m}$

Sky background
= $5 \text{ e}^-/\text{s}/\text{pixel}$

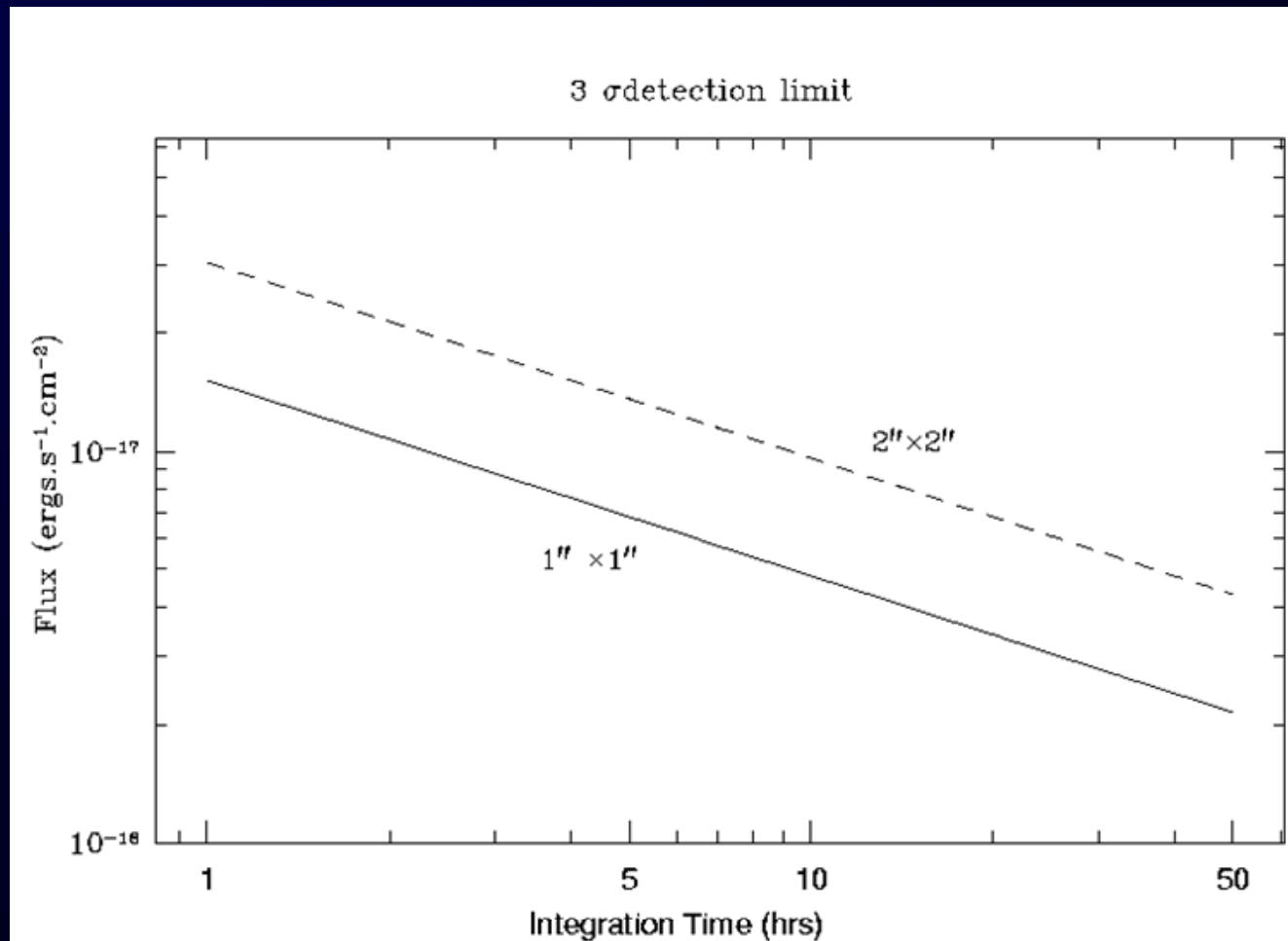
Dark time !



2 arcmin

$z = 8$ galaxies with WIRCAM

- Scaling to WIRCAM

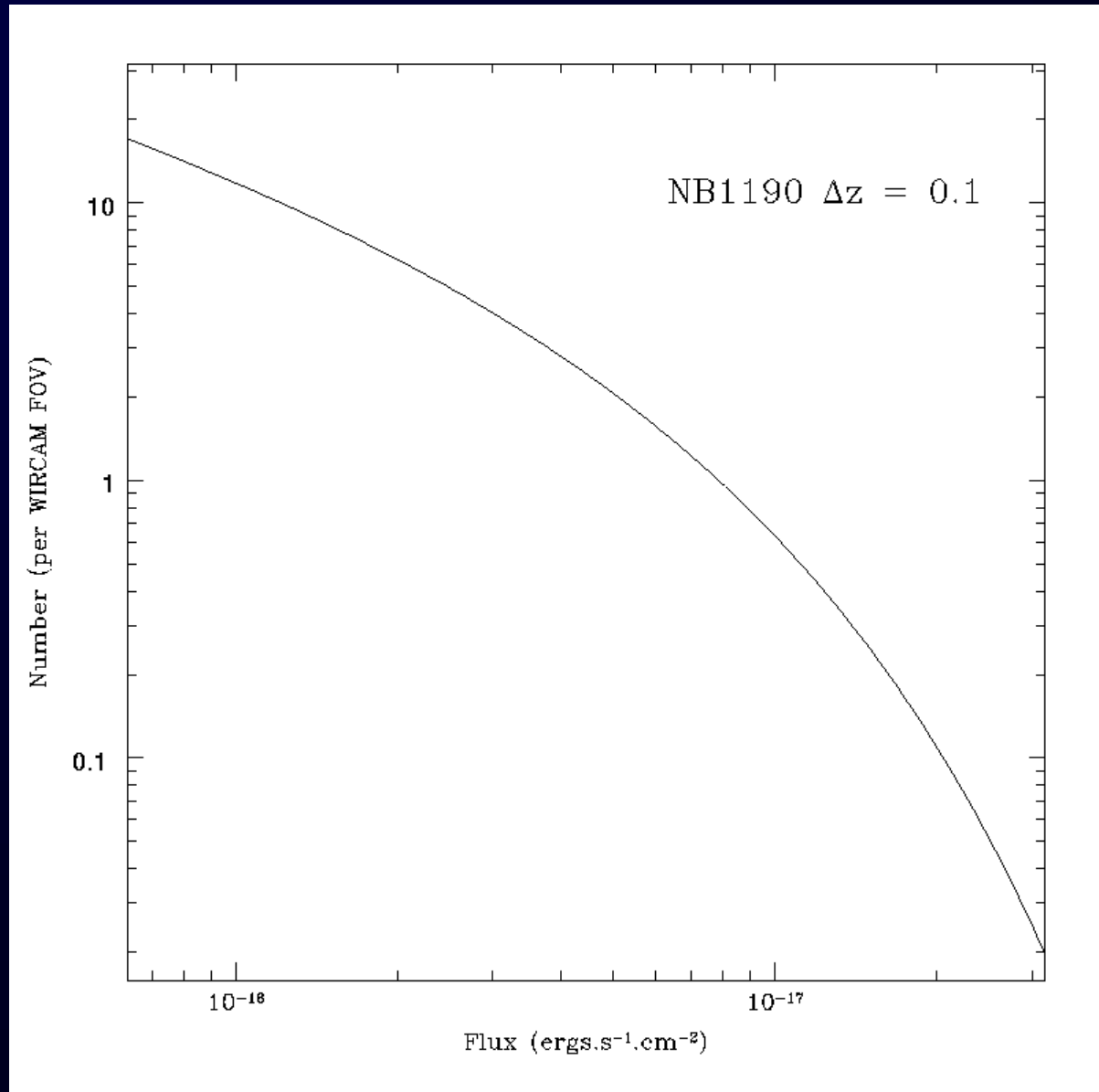


$z = 8$ galaxies with WIRCAM

$\text{Ly}\alpha$ Luminosity
function at $z=5.7$
(Malhotra et al., 2004)

Extrapolation to $z = 8$

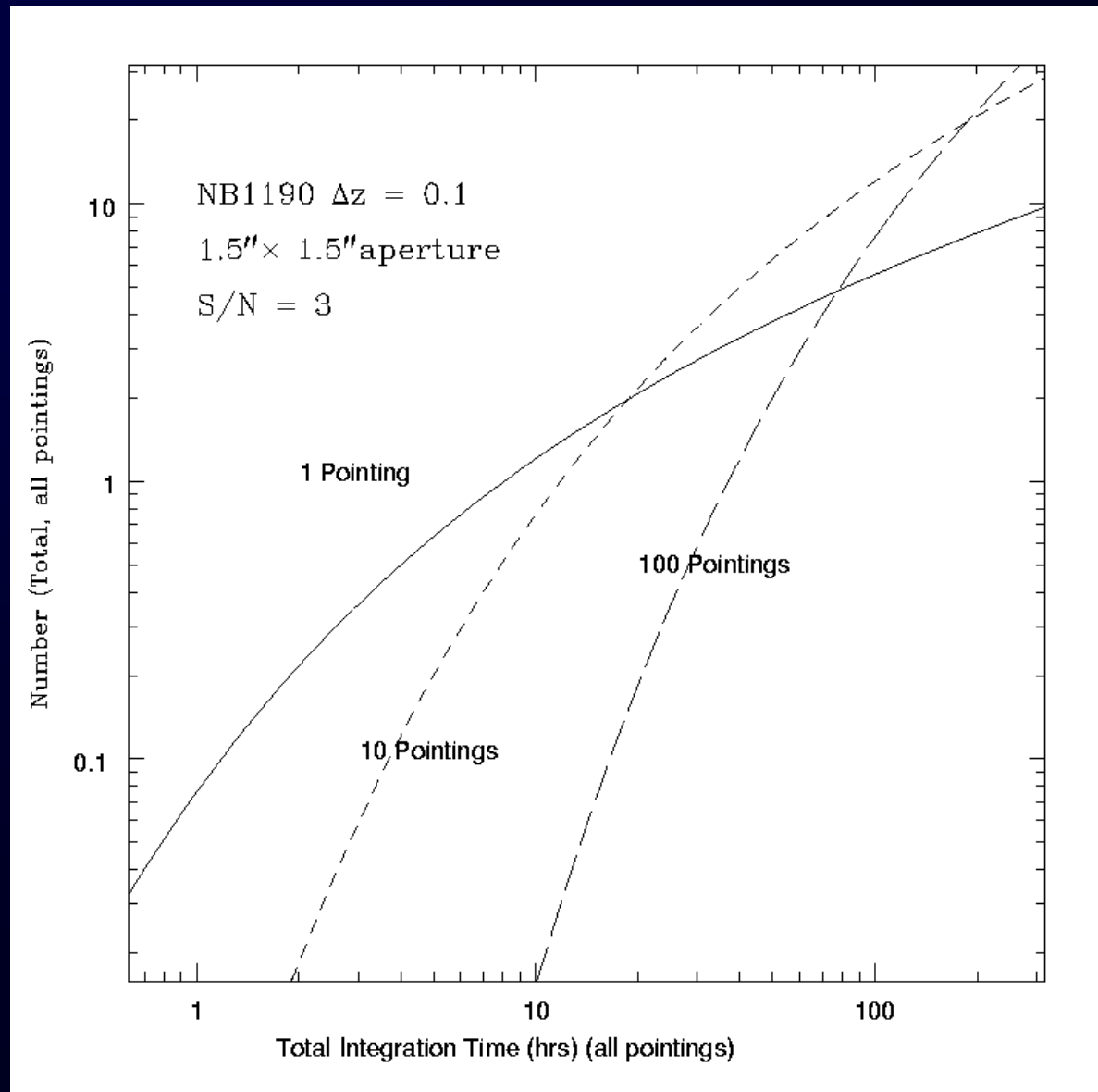
- $z=5.7$ 1 Gyr
- $z=8$ 0.6 Gyr



$z = 8$ galaxies with WIRCAM

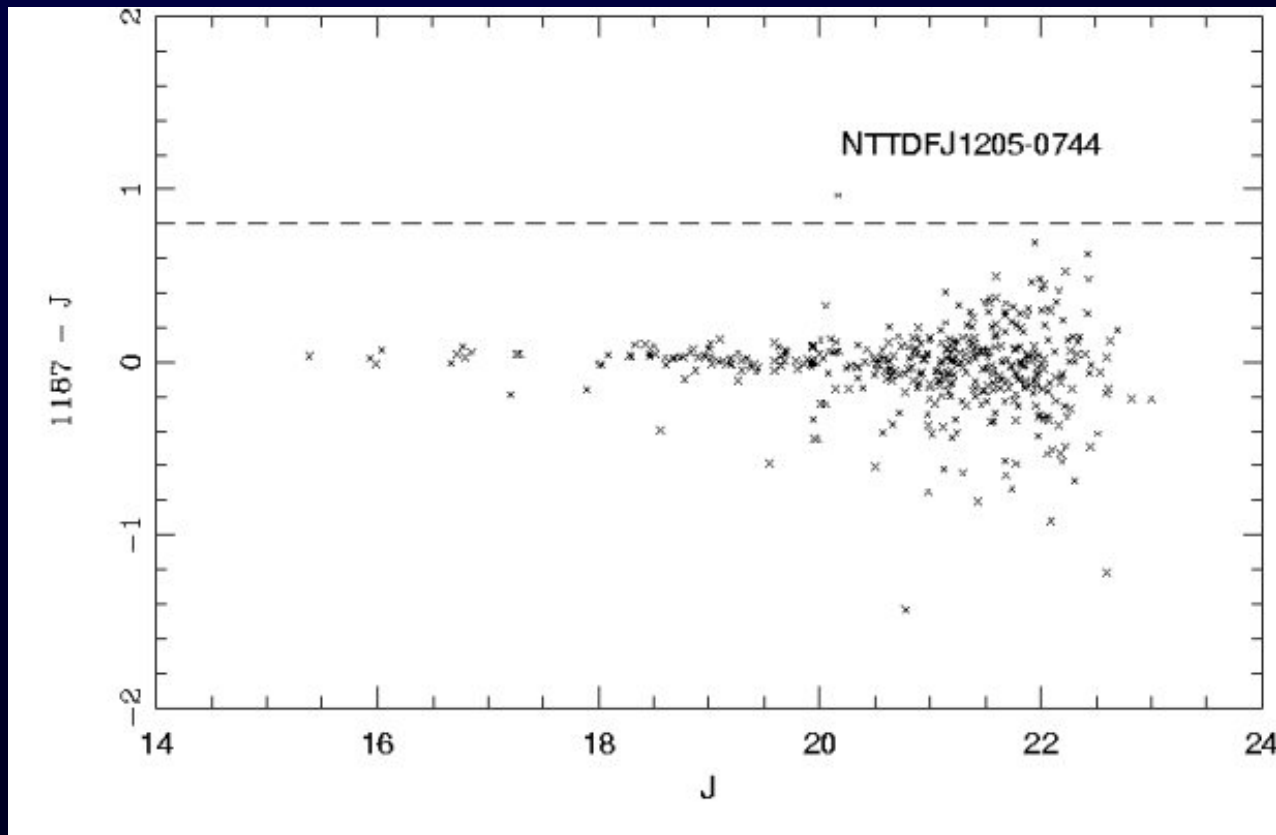
Combining LF
extrapolation and
filter detection limit
vs time

Need to optimize
integration time per
pointing and
number of
pointings



By-products: T-dwarfs

Color-mag diagram NTT Deep Field.



$(1190 - J)$ versus J

Conclusions

- 10-20 nights should allow detection of 10-20 $z = 8$ galaxies
- CFHT/WIRCAM competitive with VLT/HAWK-I ($8' \times 8'$ fov)
- Need (very) deep BB J (at least), and as many other bands as possible: U-I, Y, H, K
- LP or PI program ?