ARE THE MOST MASSIVE GALAXIES SVBSTANTIALLY DIFFERENT VSING THE DEEPEST SVRVEYS?

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ASTRODEEP

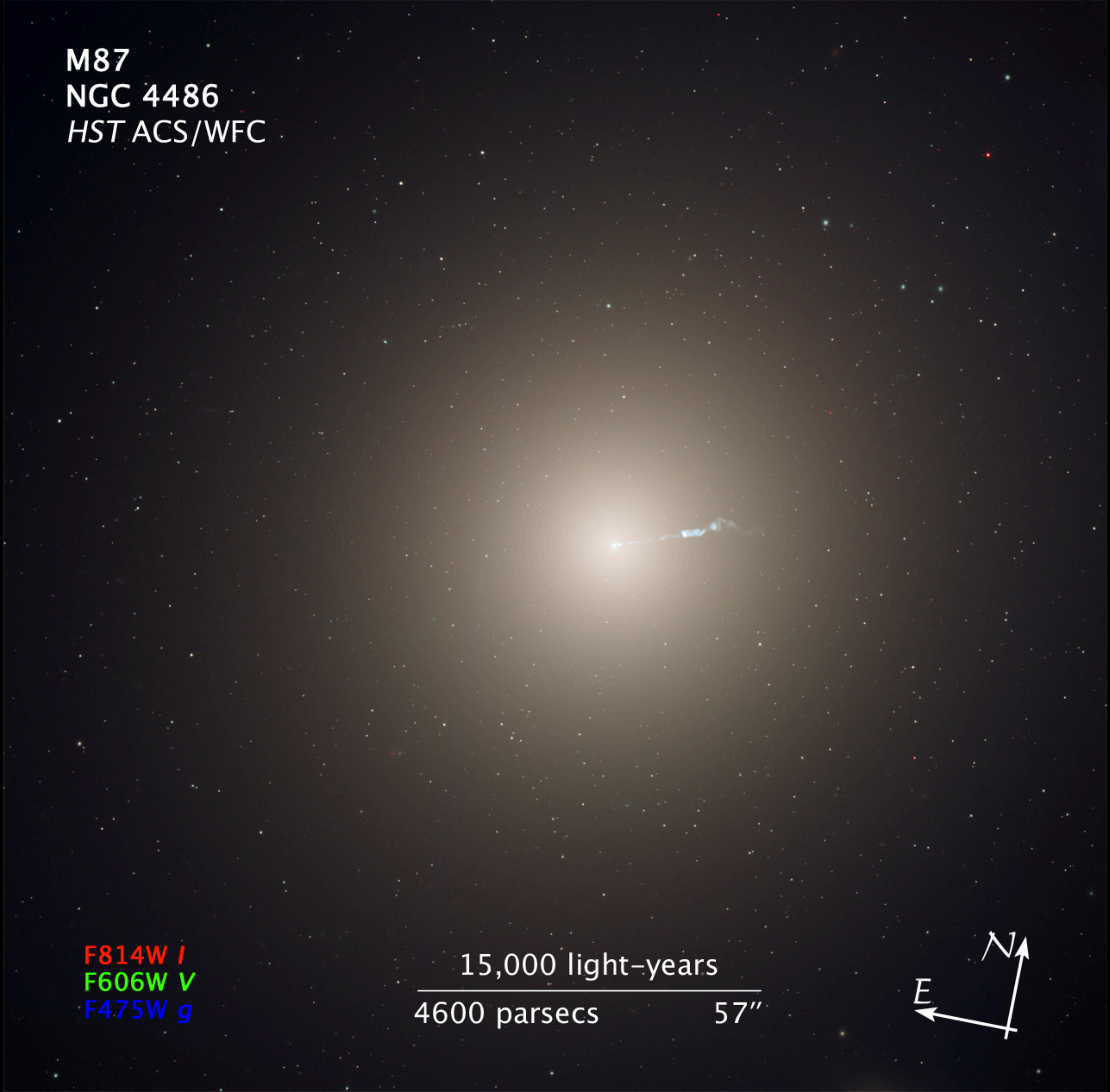
ROYAL OBSERVATORY EDINBURGH

THE UNIVERSITY OF EDINBURGH

SUPA

OUTLINE

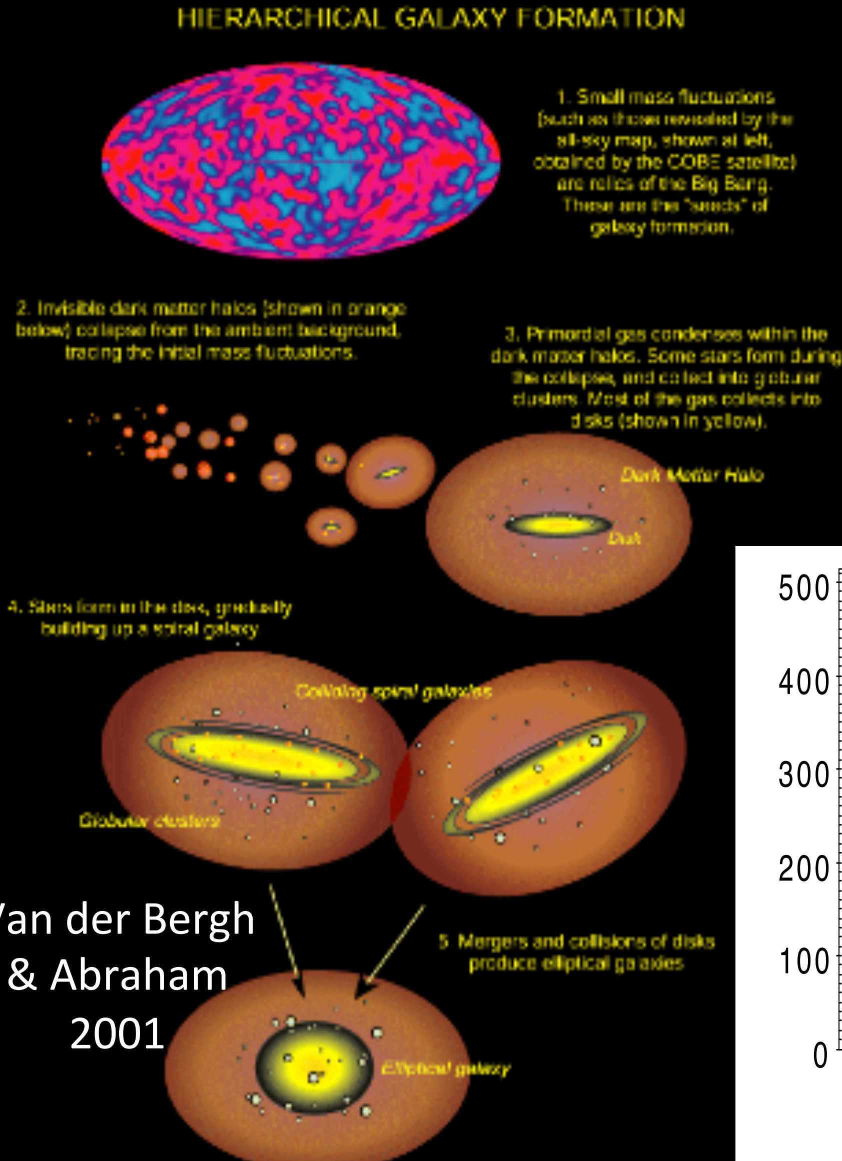
- Why should we care about the massive end of the galaxy mass function?
- Limitations to our knowledge: surface brightness dimming
- Low-z Universe
- High-z Universe
- Conclusions



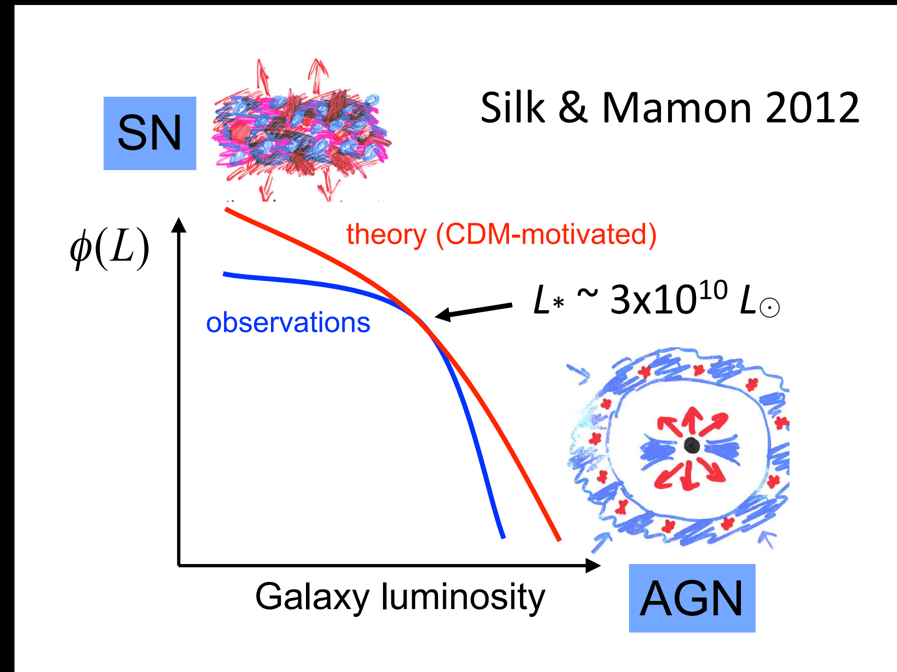
Not all galaxies in the Universe have beautiful spiral arms…

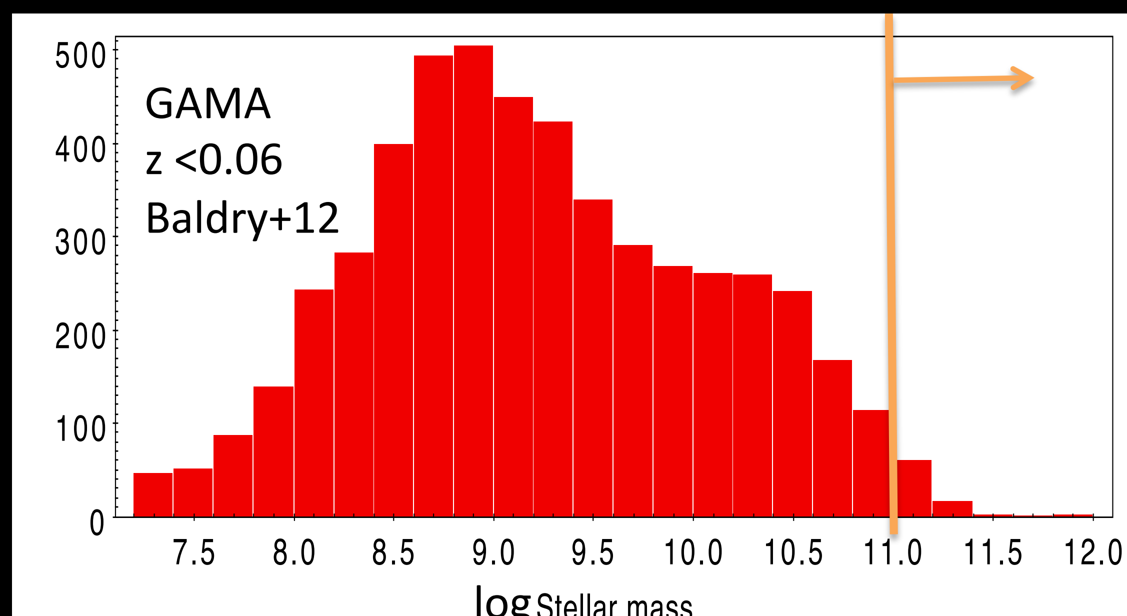
The galaxy monsters contain up to 50% of the stars in the local Universe

MASSIVE GALAXIES IN ΛCDM

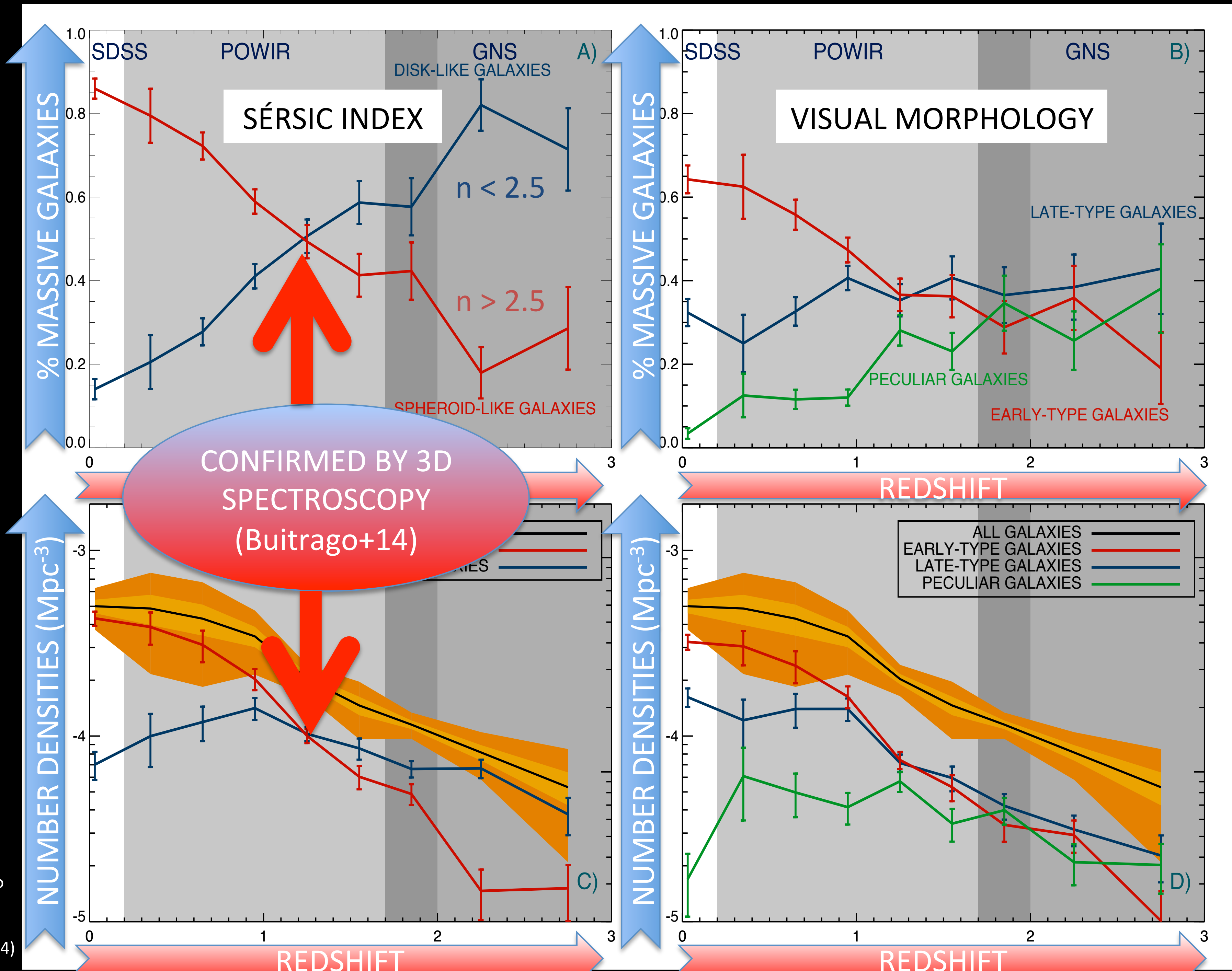


Van der Bergh & Abraham 2001





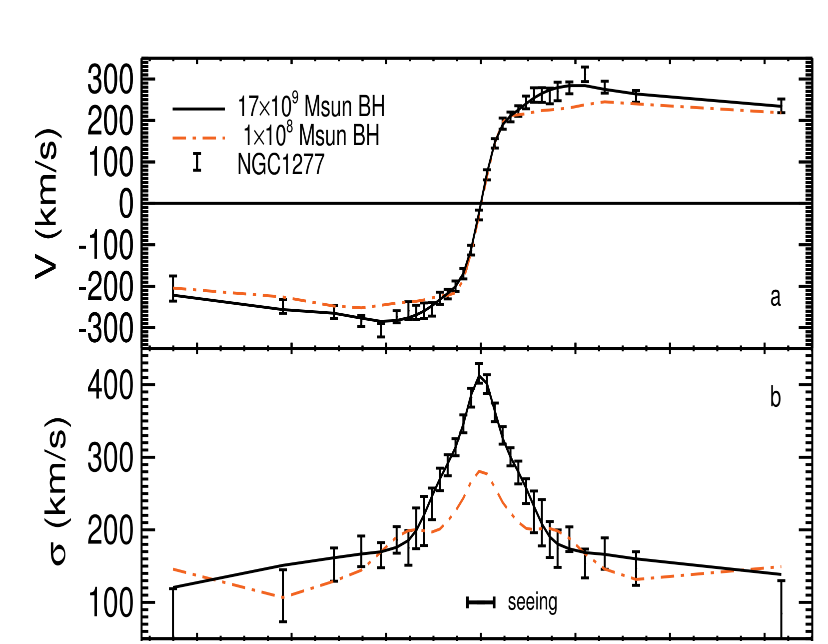
EVOLUTION OF MASSIVE GALAXIES (Buitrago et al. 2013)

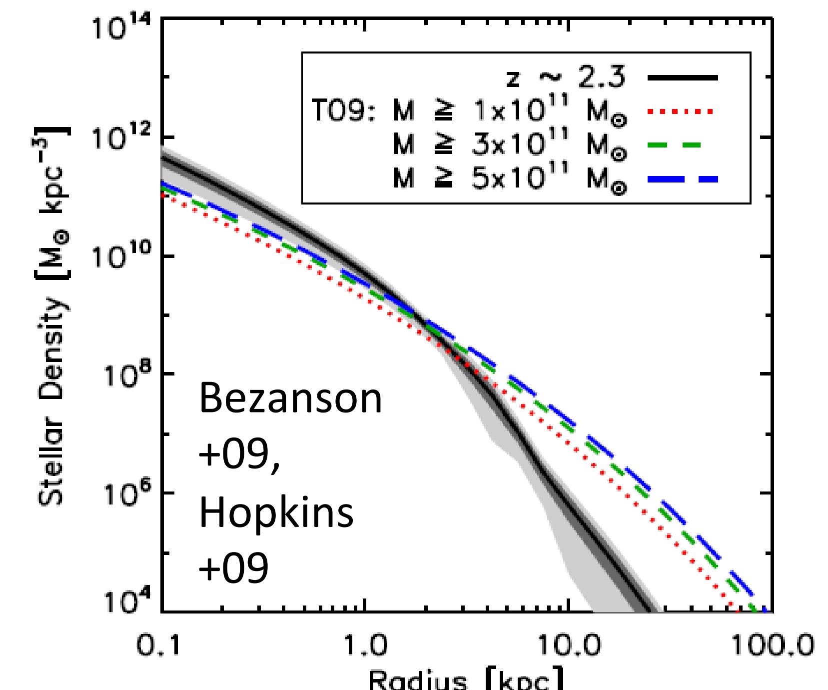


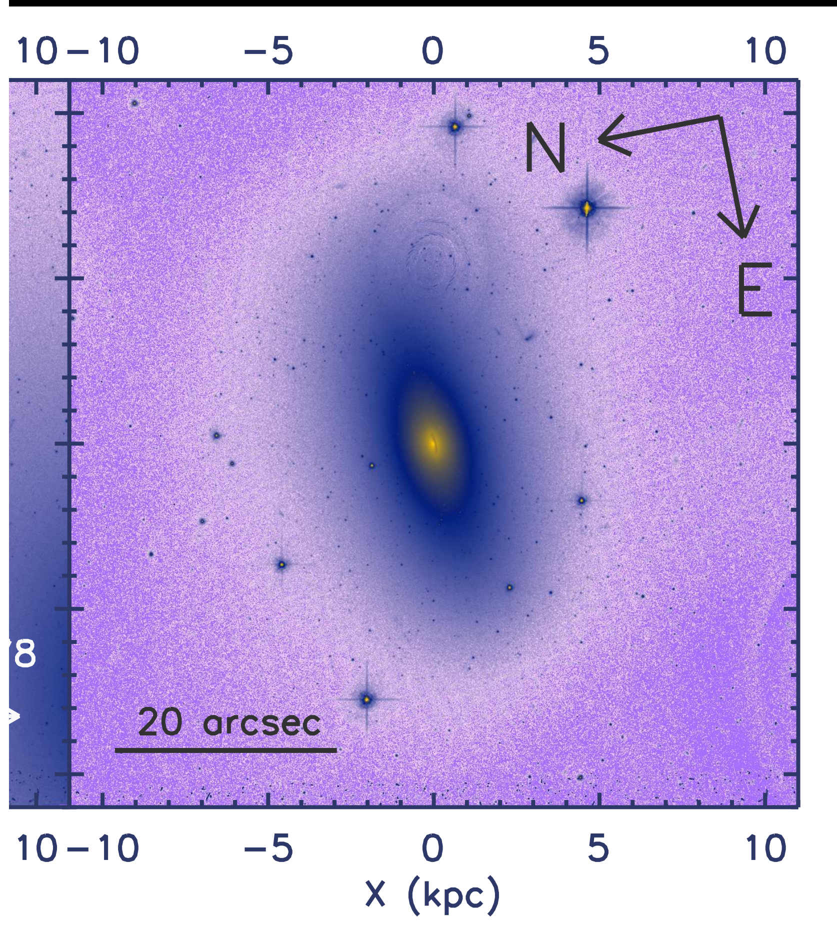
(see also Van der Wel+11, Bruce+14)

NGC1277 @ 73 Mpc

r_e=1.2 kpc, $M_{stellar}=1.2\times10^{11}\ M_\odot$

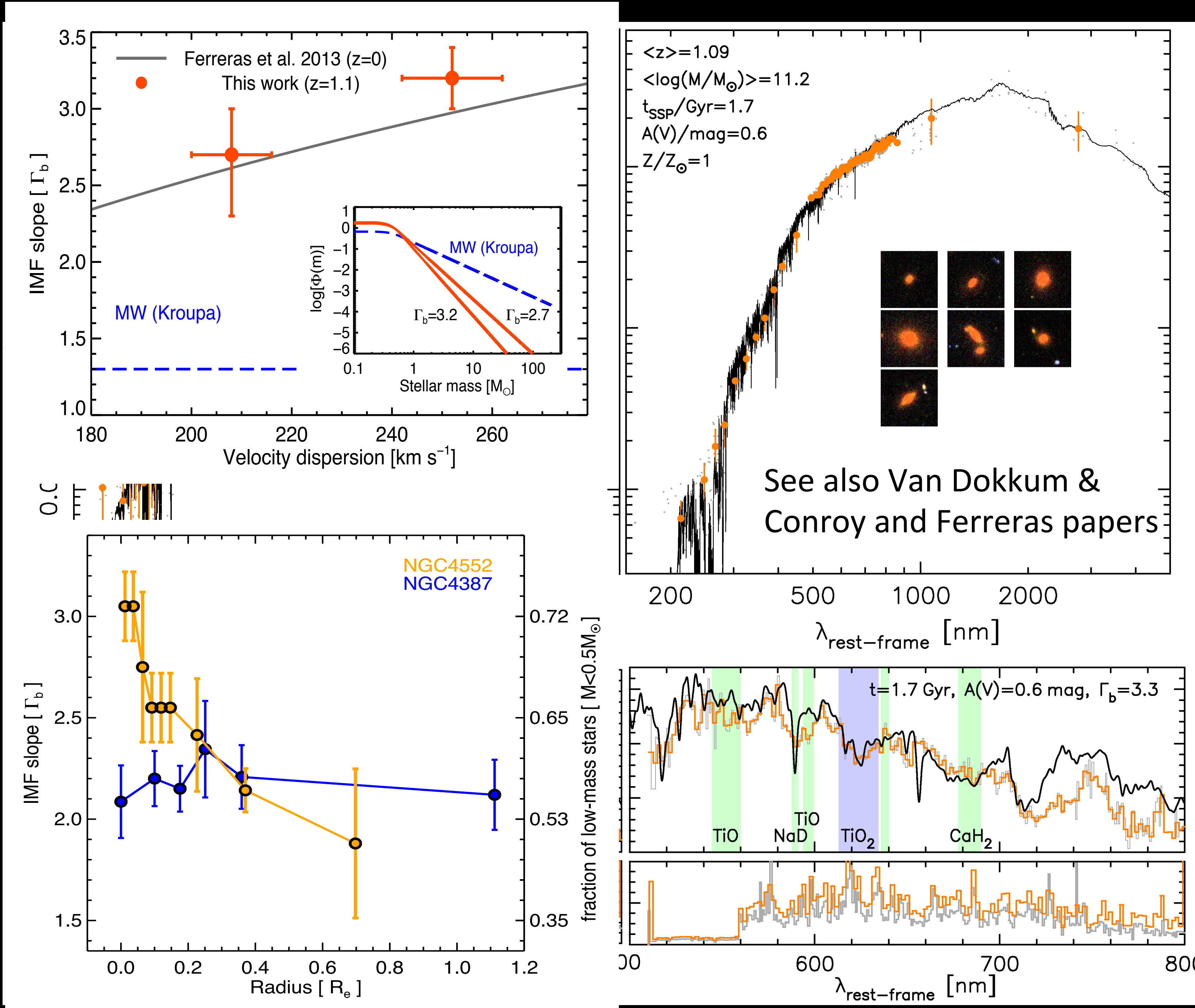






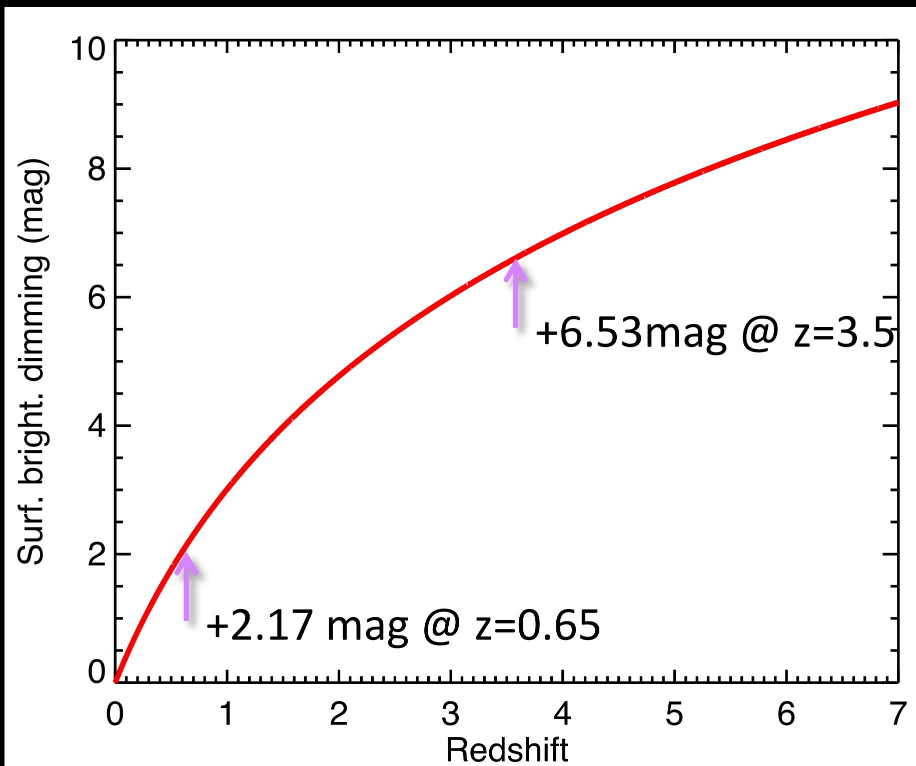
Van der Bosch et al. 2012, Trujillo et al. 2014

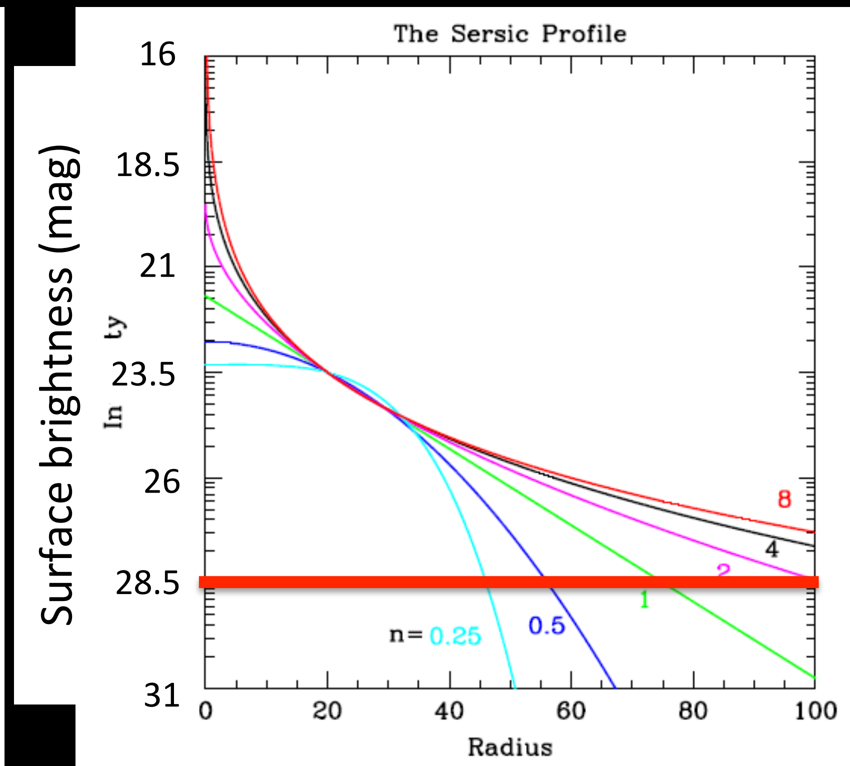
Martín-Navarro et al. 2014a,b (within SHARDS)



OBSERVATIONAL PROBLEMS

- Surface brightness dimming at high-z
  - The factor $(1+z)^{-4}$ => +10 log (1+z)



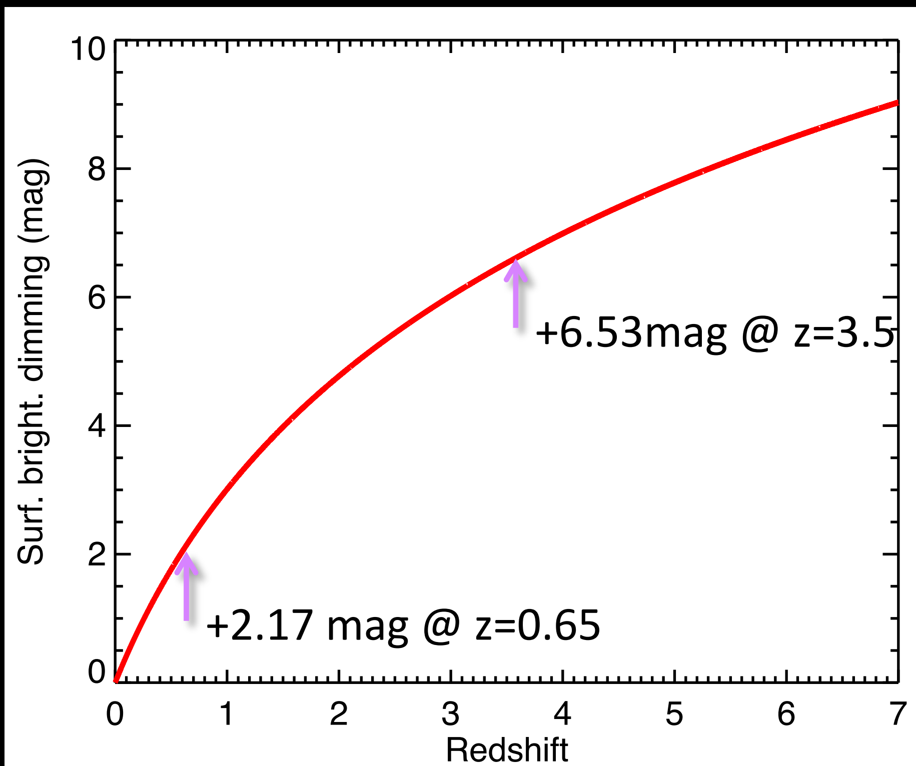


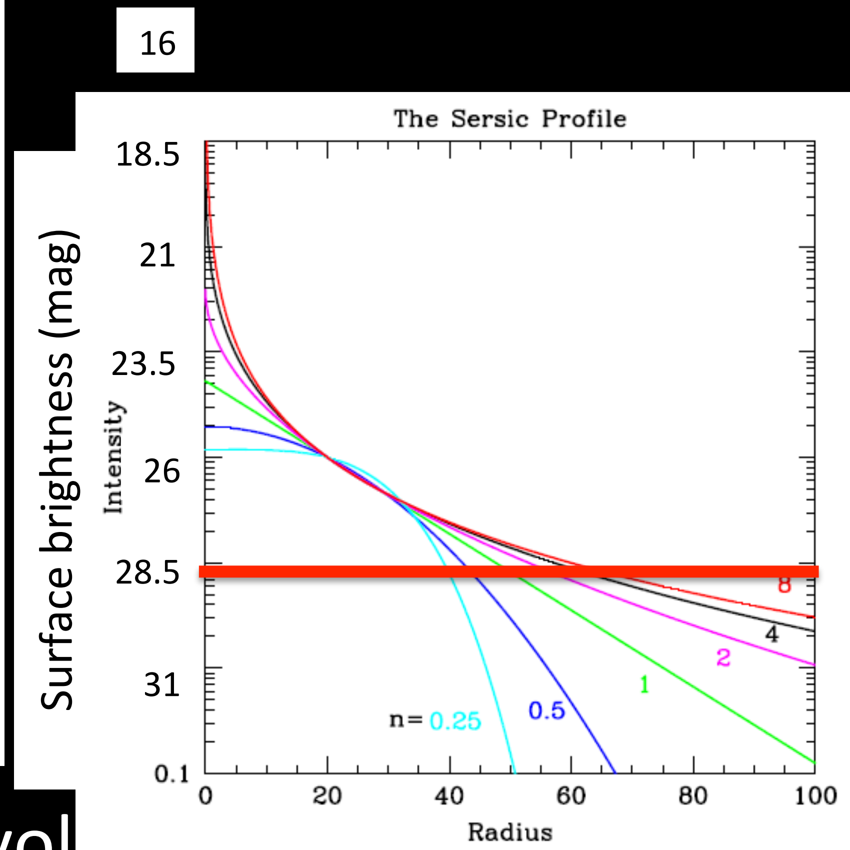
- Limitations in our stellar evol. codes, photometry, difficulty to get (decent) spectra...

OBSERVATIONAL PROBLEMS

- Surface brightness dimming at high-z
  - The factor $(1+z)^4$ => +10 log (1+z)

z = 0.65



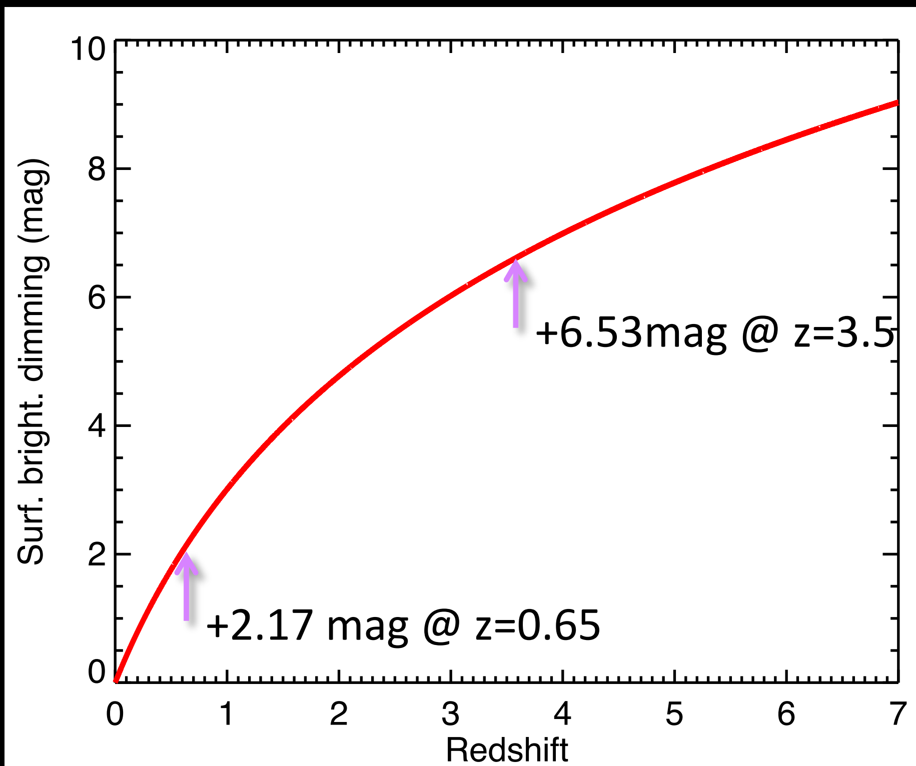


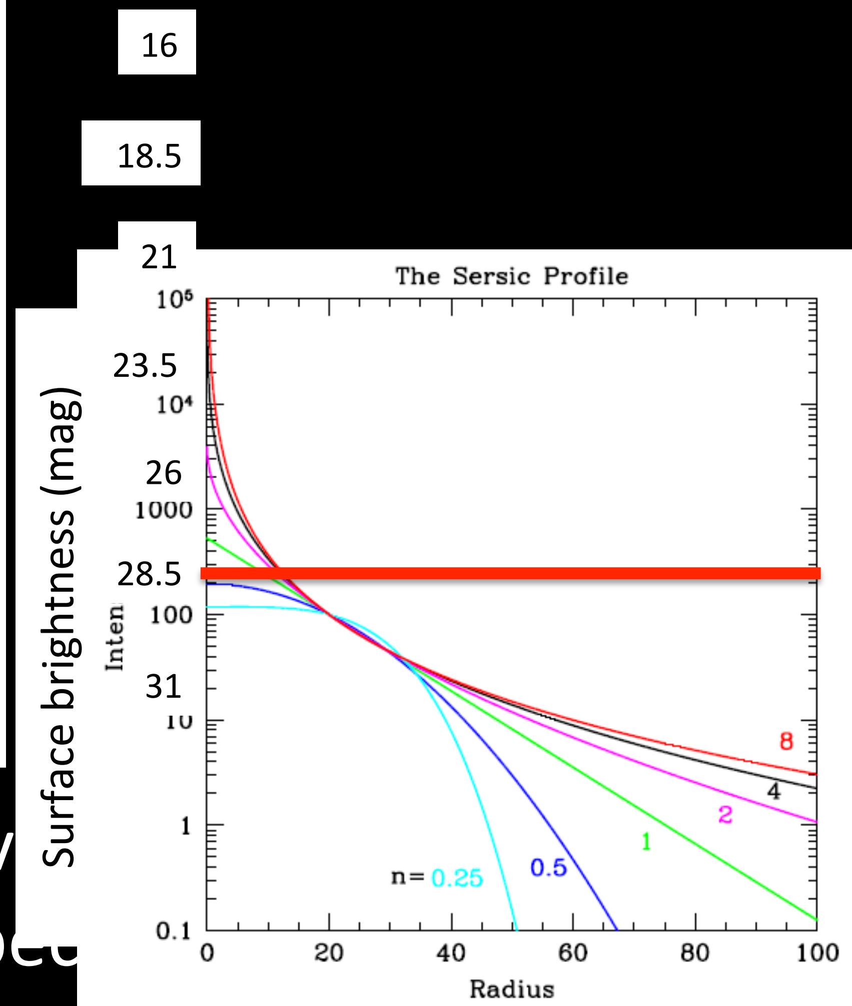
- Limitations in our stellar evol
  difficulty to get (decent) spectra...

OBSERVATIONAL PROBLEMS

- Surface brightness dimming at high-z
  - The factor $(1+z)^4$ => +10 log (1+z)

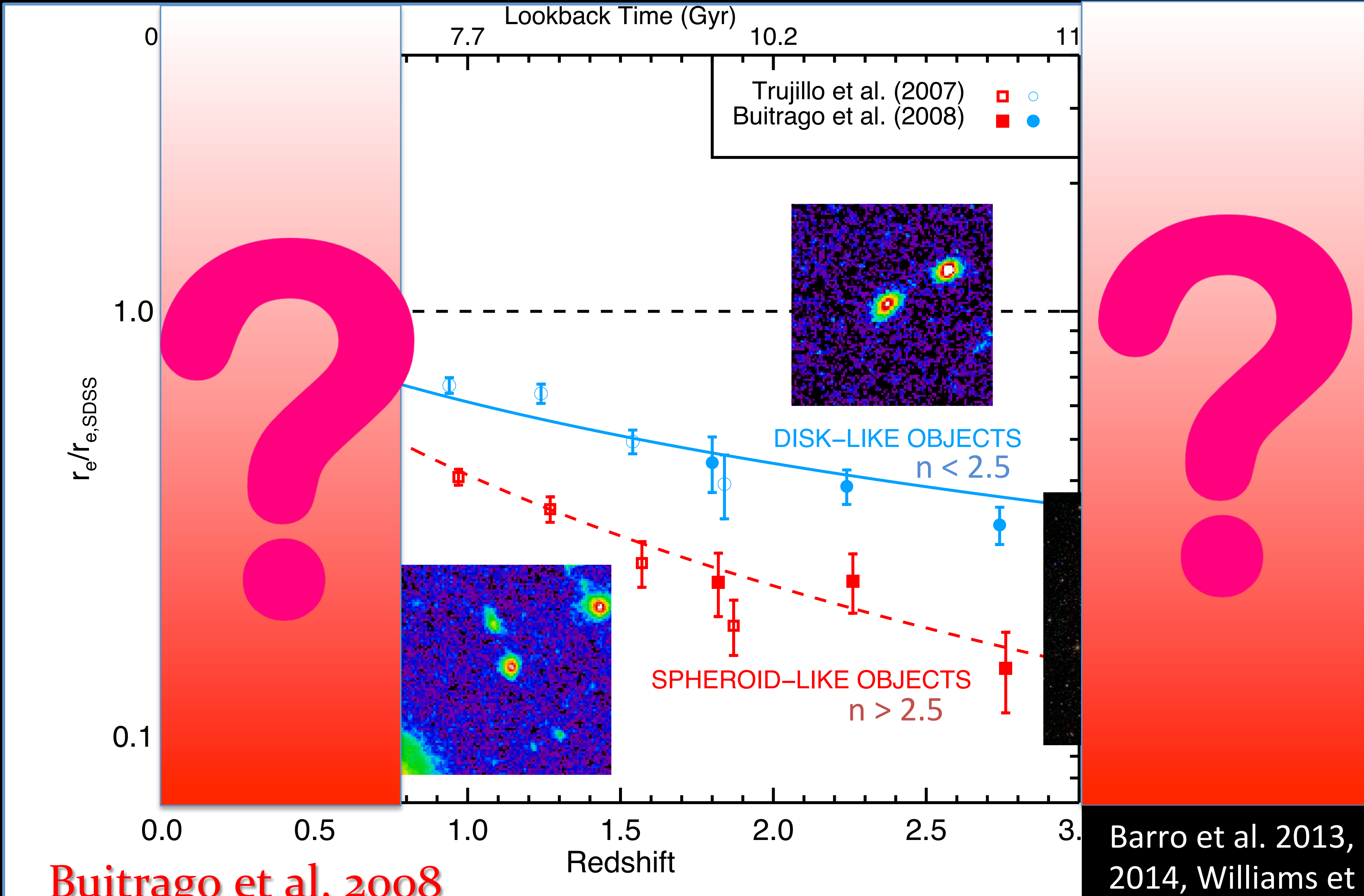
z = 3.5





- Limitations in our stellar ev
difficulty to get (decent) spe

EVOLUTION IN SIZE



Buitrago et al. 2008

Barro et al. 2013, 2014, Williams et al. 2014

HUDF12
(PI Ellis & McLure)
Ellis et al. 2012
Koekemoer et al. 2012

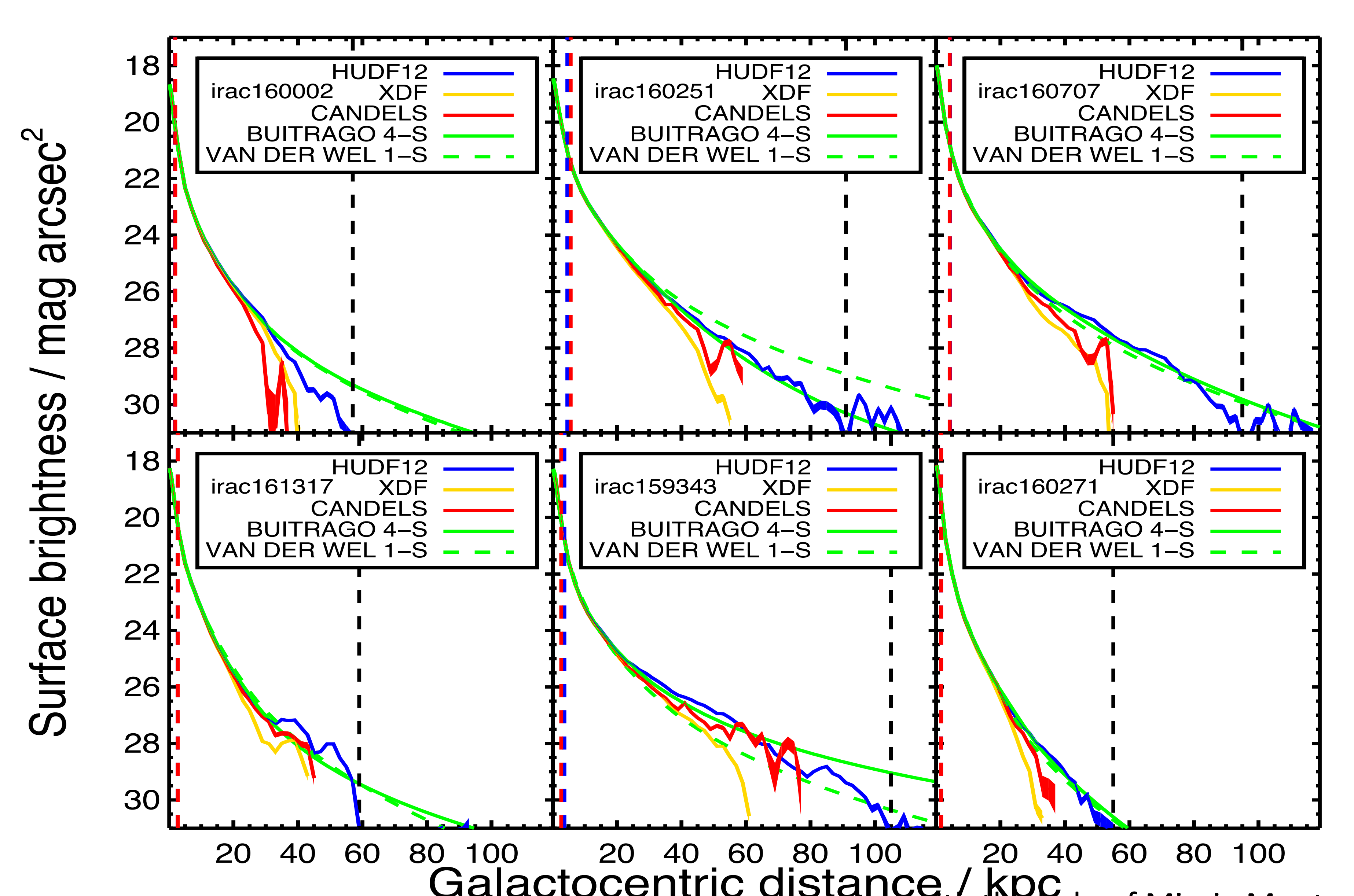
x2 in WFC3,
x4 in Y_{105},
first time J_{140}

+ ACS optical coverage

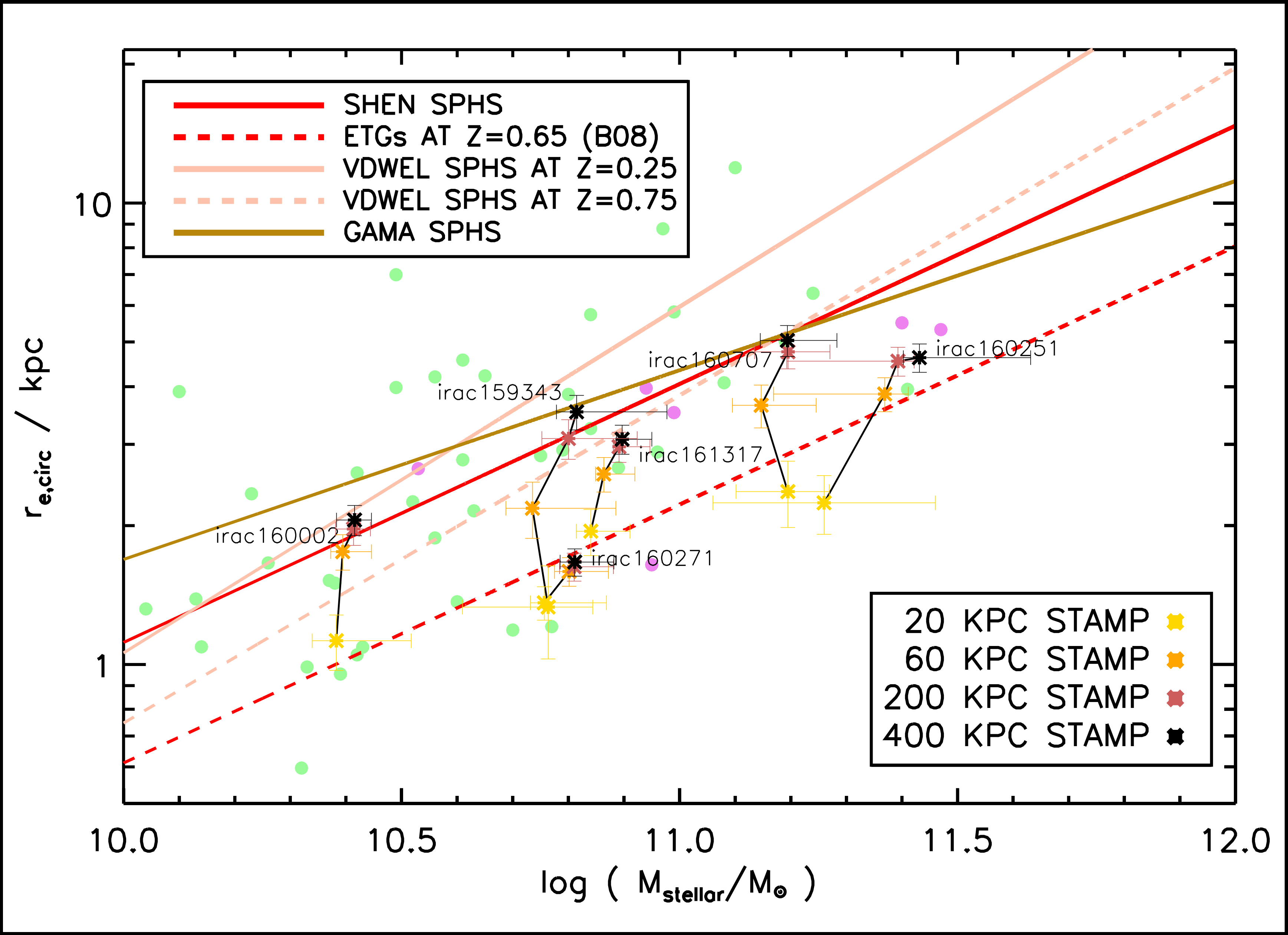
653 orbits
5σ~30 mag”^{2}

Investigating the low surface brightness stellar haloes at z = 0.65! or how to use HUDF for low-z

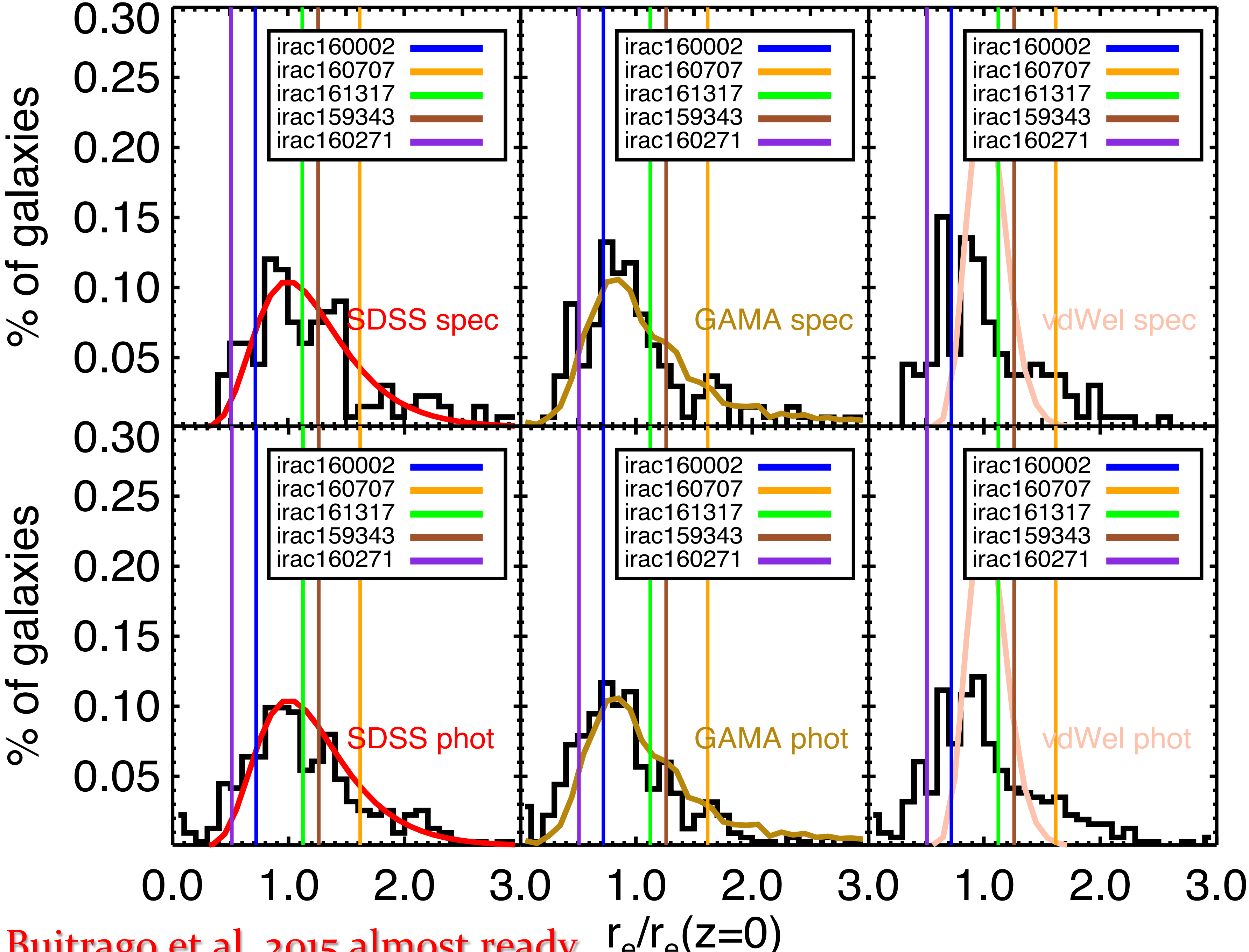
Buitrago et al. 2015 almost ready



with the help of Mireia Montes



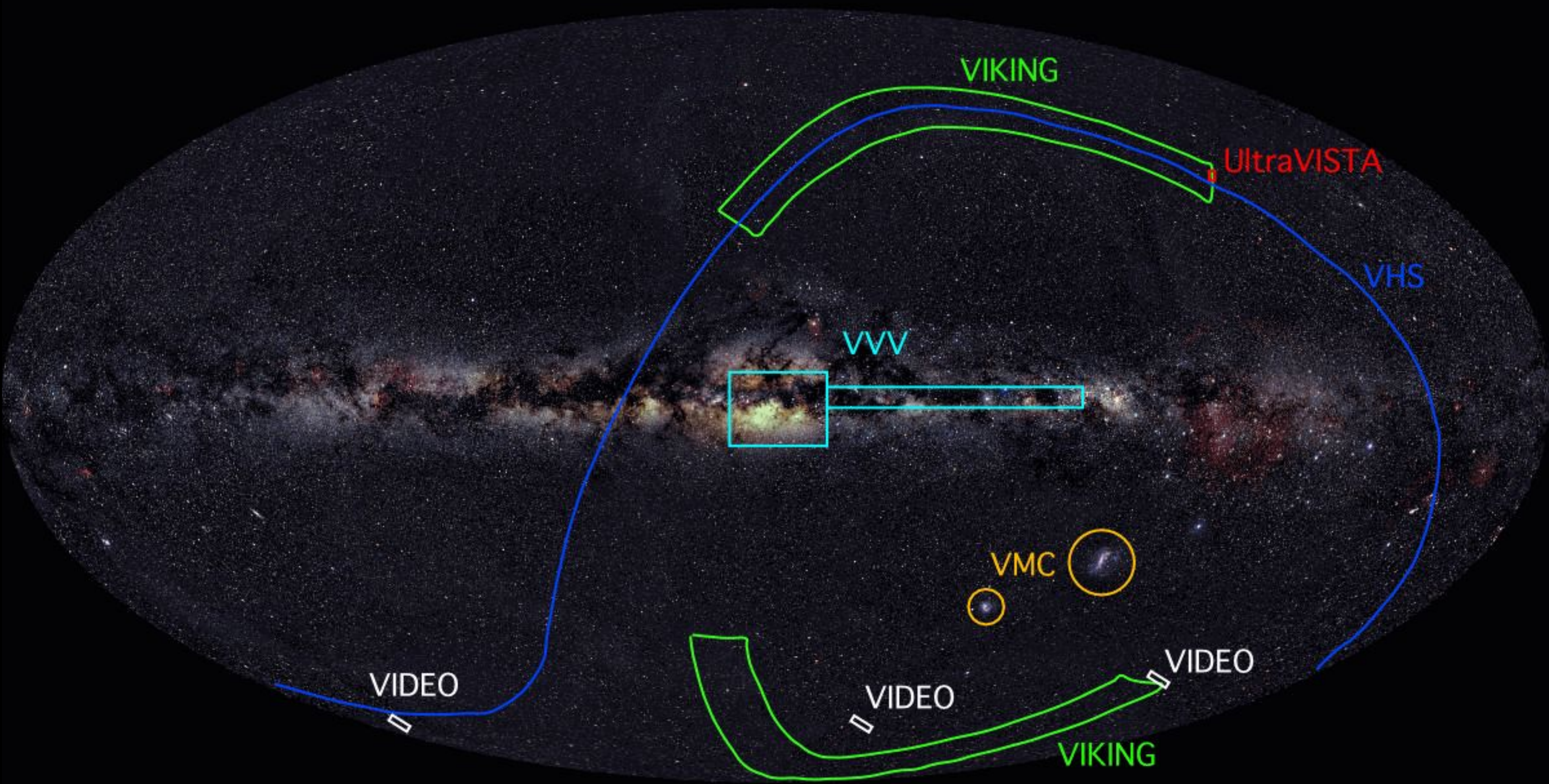
SHEN SPHS
ETGs AT Z=0.65 (B08)
VDWEL SPHS AT Z=0.25
VDWEL SPHS AT Z=0.75
GAMA SPHS
20 KPC STAMP
60 KPC STAMP
200 KPC STAMP
400 KPC STAMP
irac160002
irac159343
irac161317
irac160271
irac160707
irac160251
10
1
10.0
10.5
11.0
11.5
12.0
$\log (M_{stellar}/M_{\odot})$
$r_{e,circ}$ / kpc



Buitrago et al. 2015 almost ready

ULTRAVISTA

- VIRCAM@VISTA 4-m survey telescope
- http://www.ultravista.org/



www.astrodeep.eu

OBJECTIVES

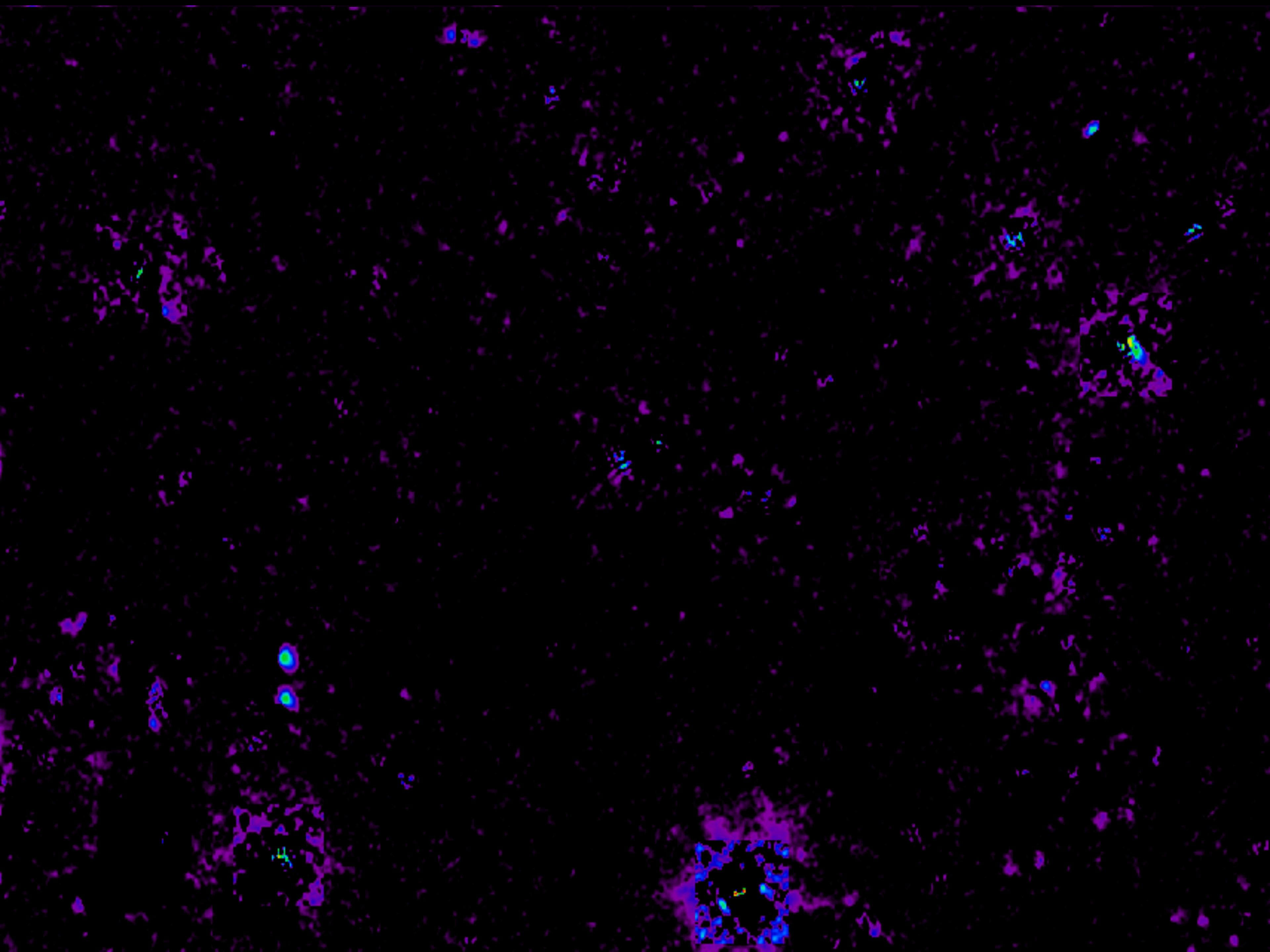
- Photometric masses & redshifts
- Double Sérsic decompositions (and bulge + disk)
- Mass/luminosity functions
- IRAC DECONFUSION ALGORITHM

K-band modelling → R_e, Sérsic index, ar, pa → IRAC normalization

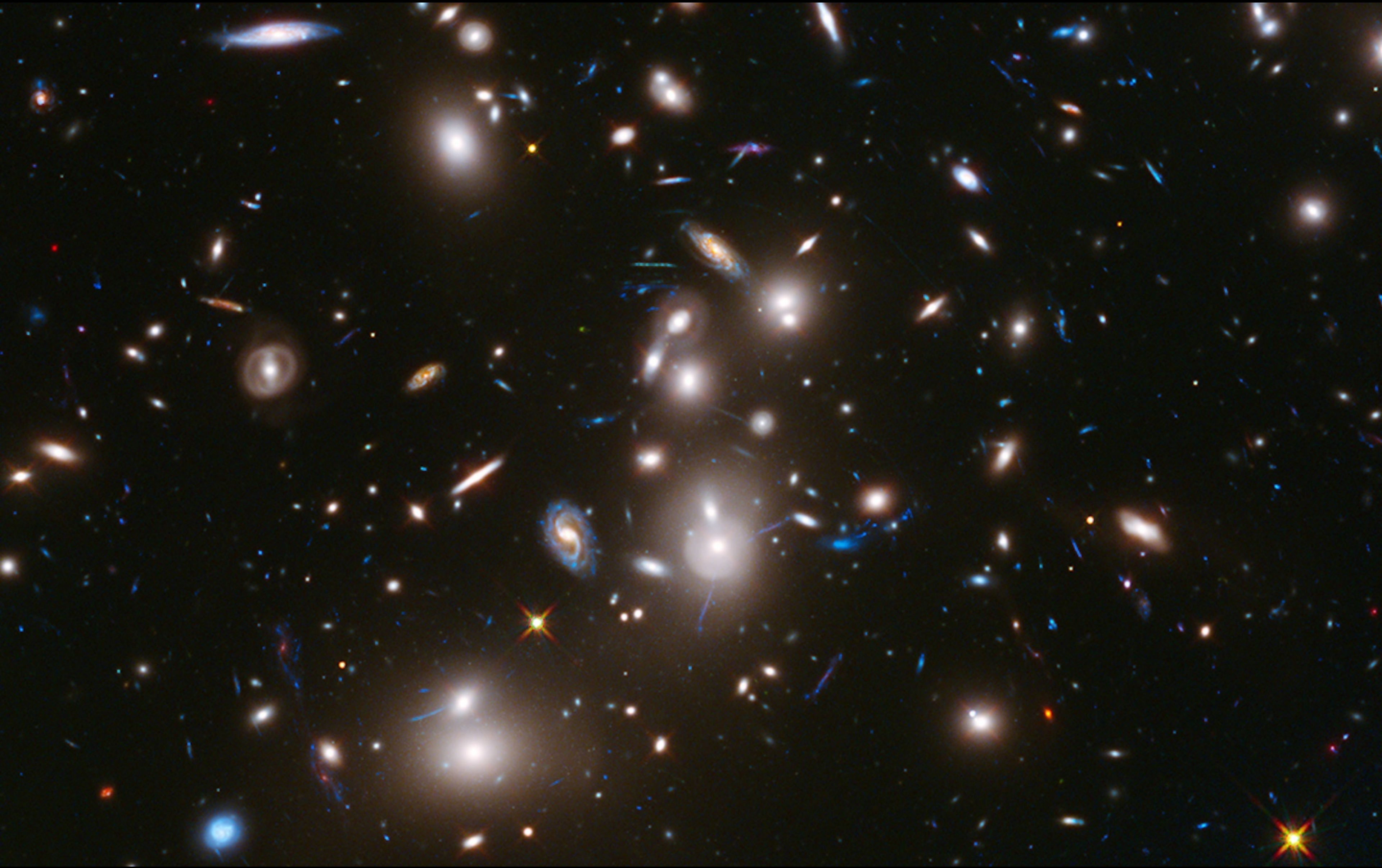
2.2 µm

3.6 & 4.5 µm

Free mag & x,y

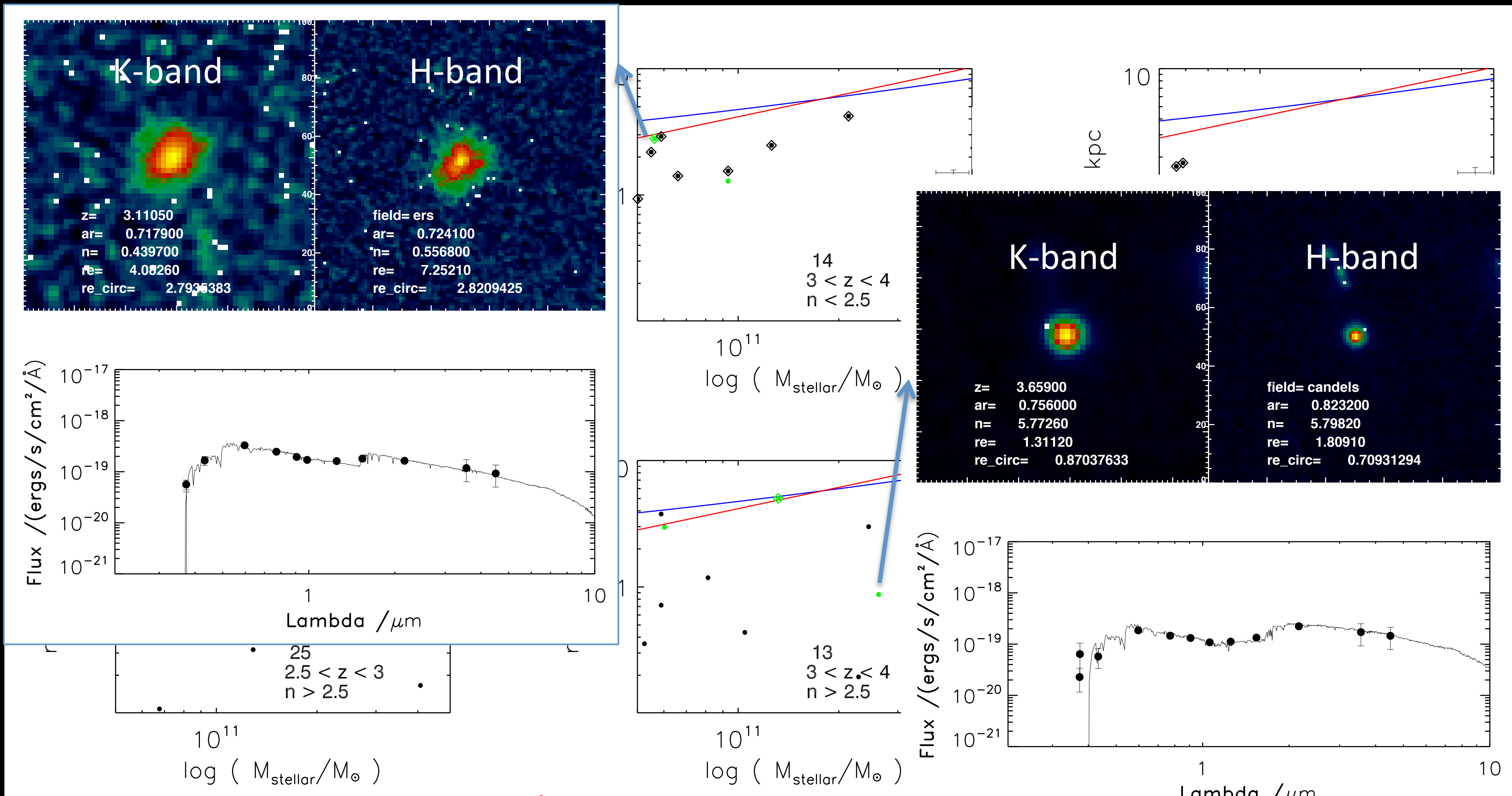


NEXT CHALLENGE: HUBBLE FRONTIER FIELDS PROGRAMME



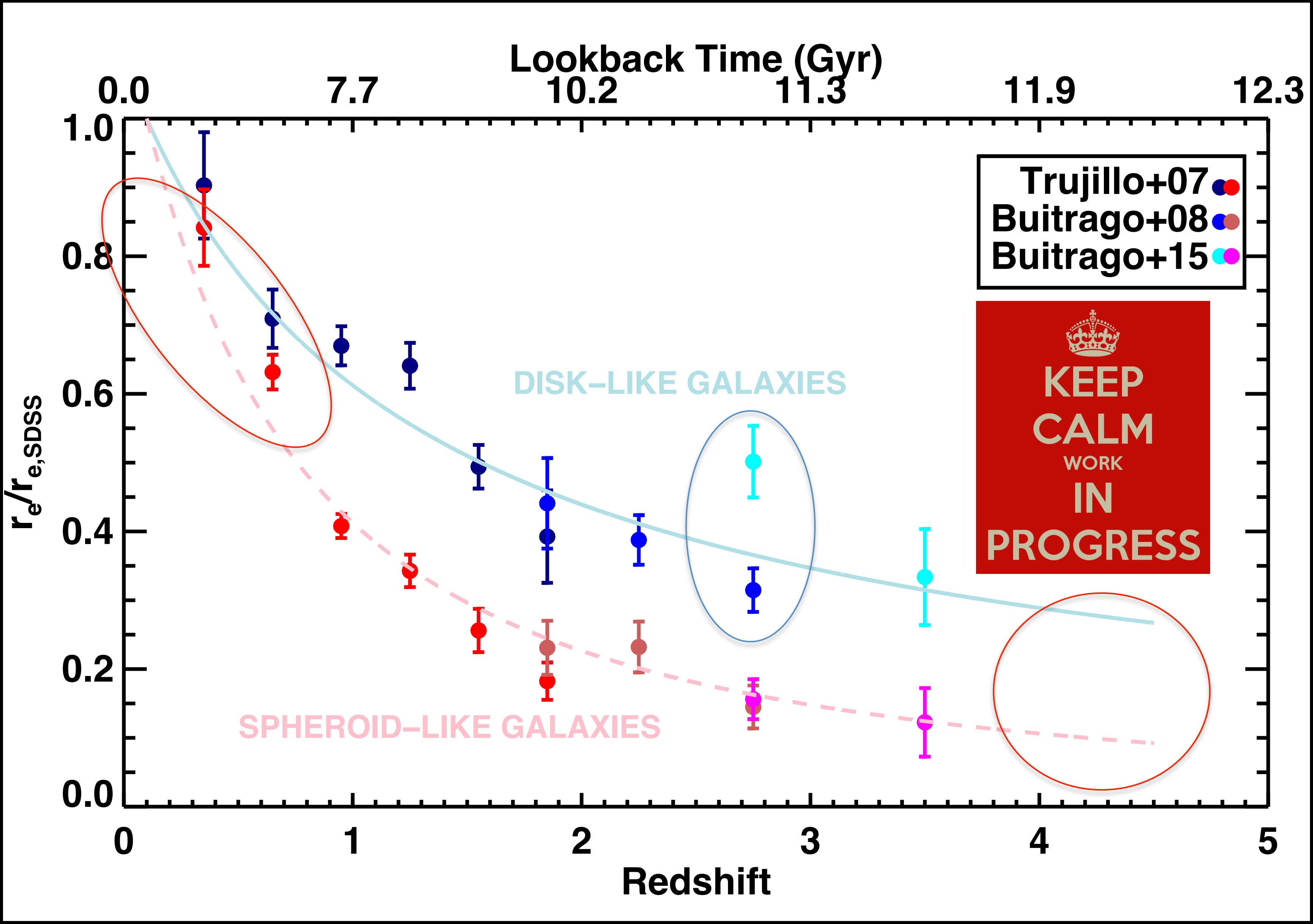
Parametric analyses of the galaxies' surface brightness are specially suited for dealing with overcrowded images: why not adding this capability to TPHOT? Merlin et al. (2015) in preparation

MASS-SIZE RELATION FOR MASSIVE GALAXIES UP TO Z=4.5 USING THE DEEPEST K-BAND SURVEY - HUGS

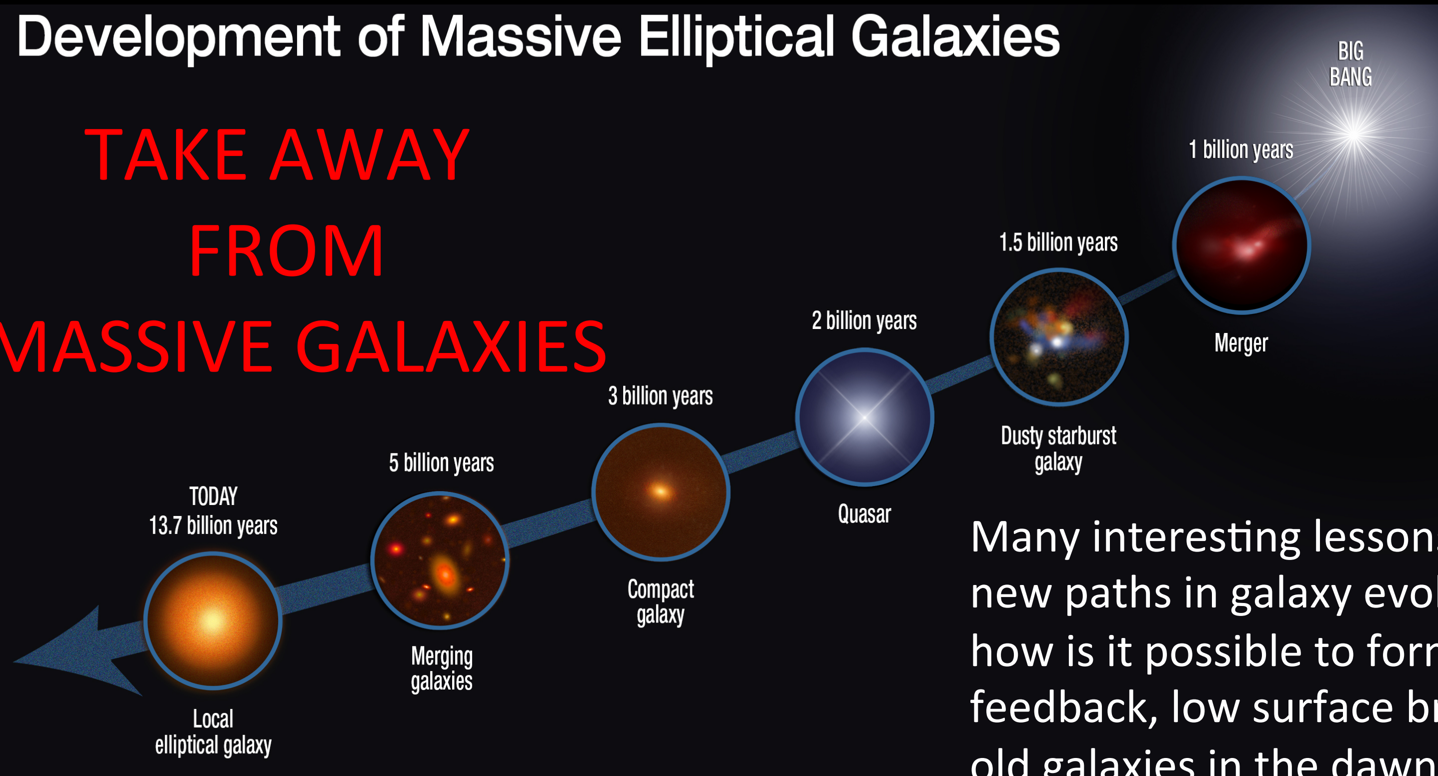


Buitrago, Targett et al. 2015 in prep.

SIZE EVOLUTION – MASSIVE – OPT. RESTFRAME



TAKE AWAY FROM MASSIVE GALAXIES



Fernando Buitrago – Sexten – Jan 2015

Compact disks → Huge spheroids

Many interesting lessons:
new paths in galaxy evolution, IMF change, how is it possible to form such galaxies, feedback, low surface brightness assembly, old galaxies in the dawn of the Universe, …

- Observational Cosmology: constraining ΛCDM
- Once we have access to the low surface brightness (up to 100 kpc or >25 r_e) size-mass rel. is accurate
- CANDELS spheroids@z=0.65 no need for size evolution
- Preliminar analysis shows extended/interacting and compact massive galaxies up to z=4.5
- Is at 1<z<3 where evolution takes place for massive galaxies?