ONGOING ASSEMBLY OF ETGS IN HVDF12

in the context of massive galaxy evolution

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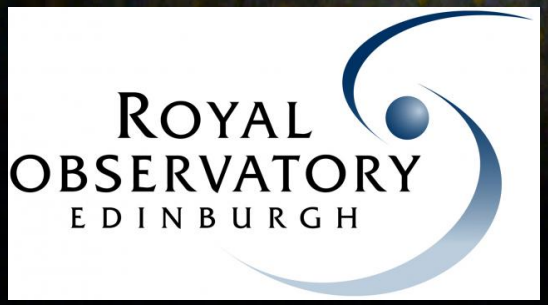
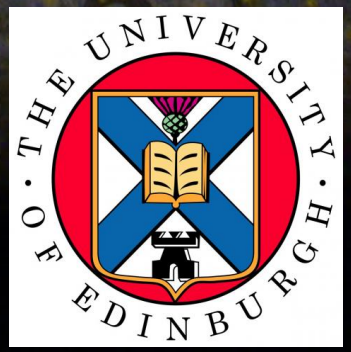
In collaboration with: M. Montes-Quiles, I. Trujillo, B. Epinat, J. Dunlop, R. McLure, C. Conselice

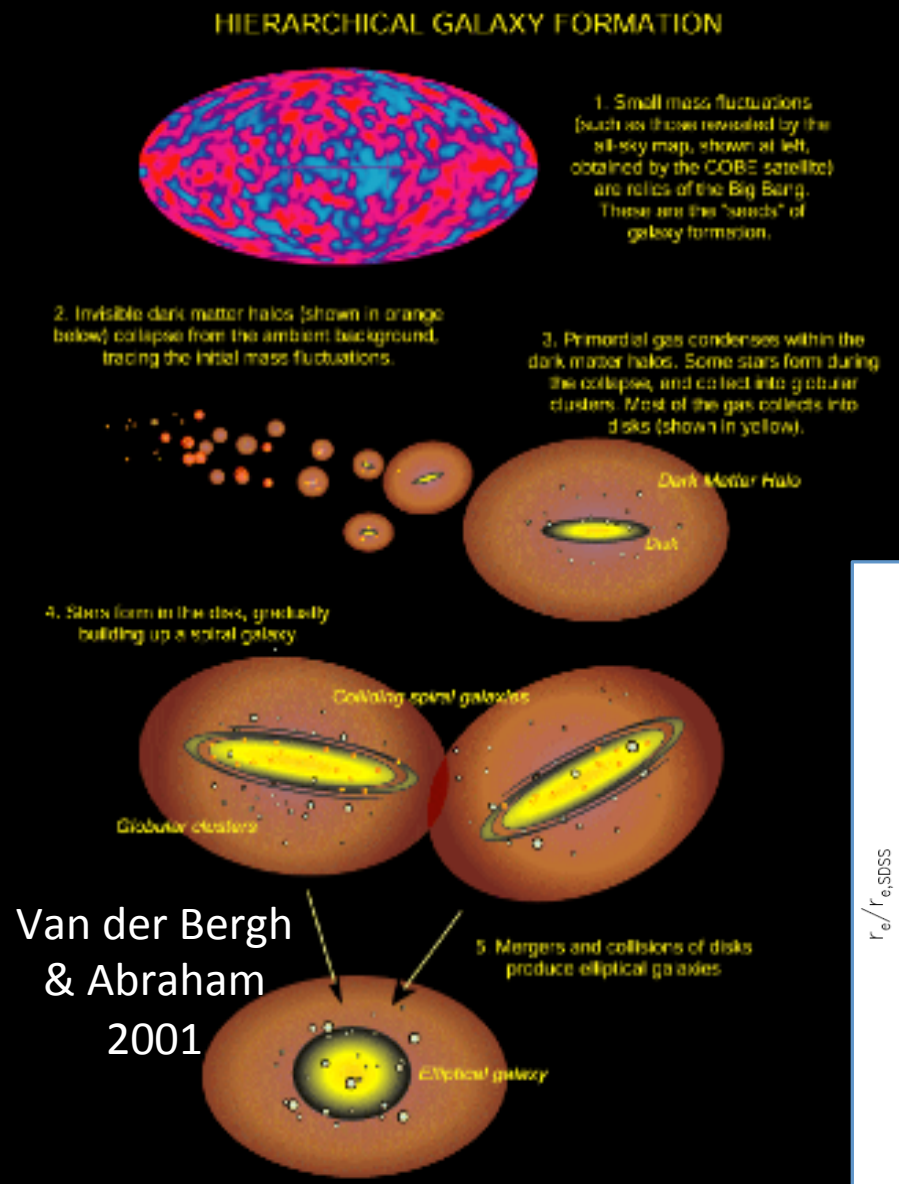




INDEX

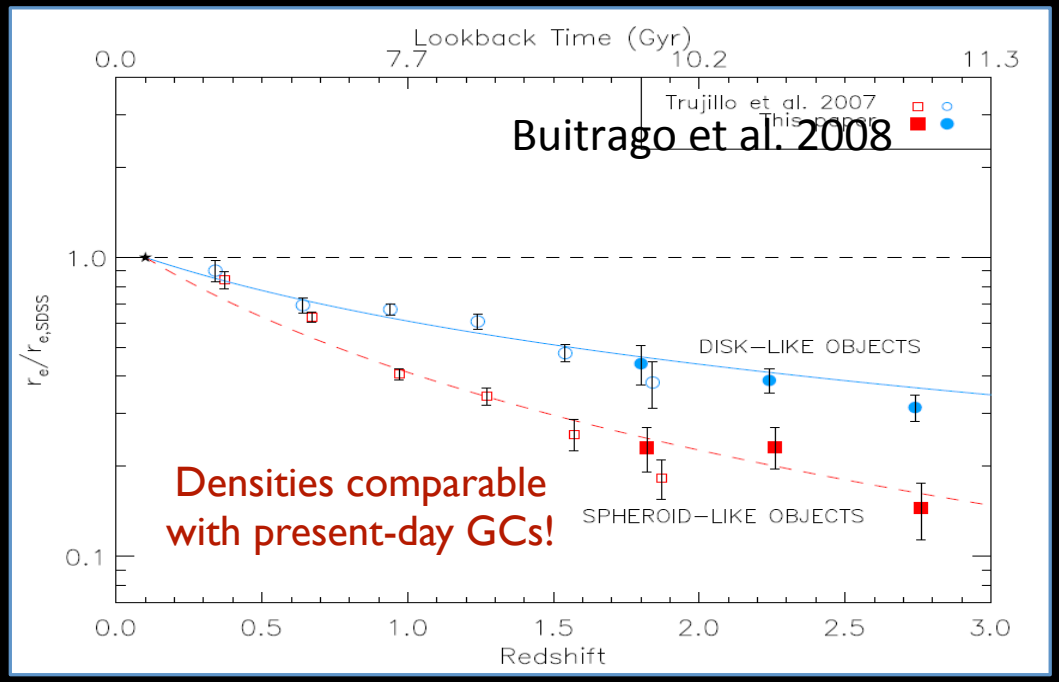
- Massive galaxies matter, at least in ΛCDM
- Morphological evolution
  - Photometric view (Buitrago et al. 2013a)
  - 3D Spectroscopic view (Buitrago et al. 2013b)
- Conclusions / Motivation
- HUDF for “local” Universe studies!!
- Galaxy assembly of HUDF ETGs at $z < 1$

MASSIVE GALAXIES IN ΛCDM

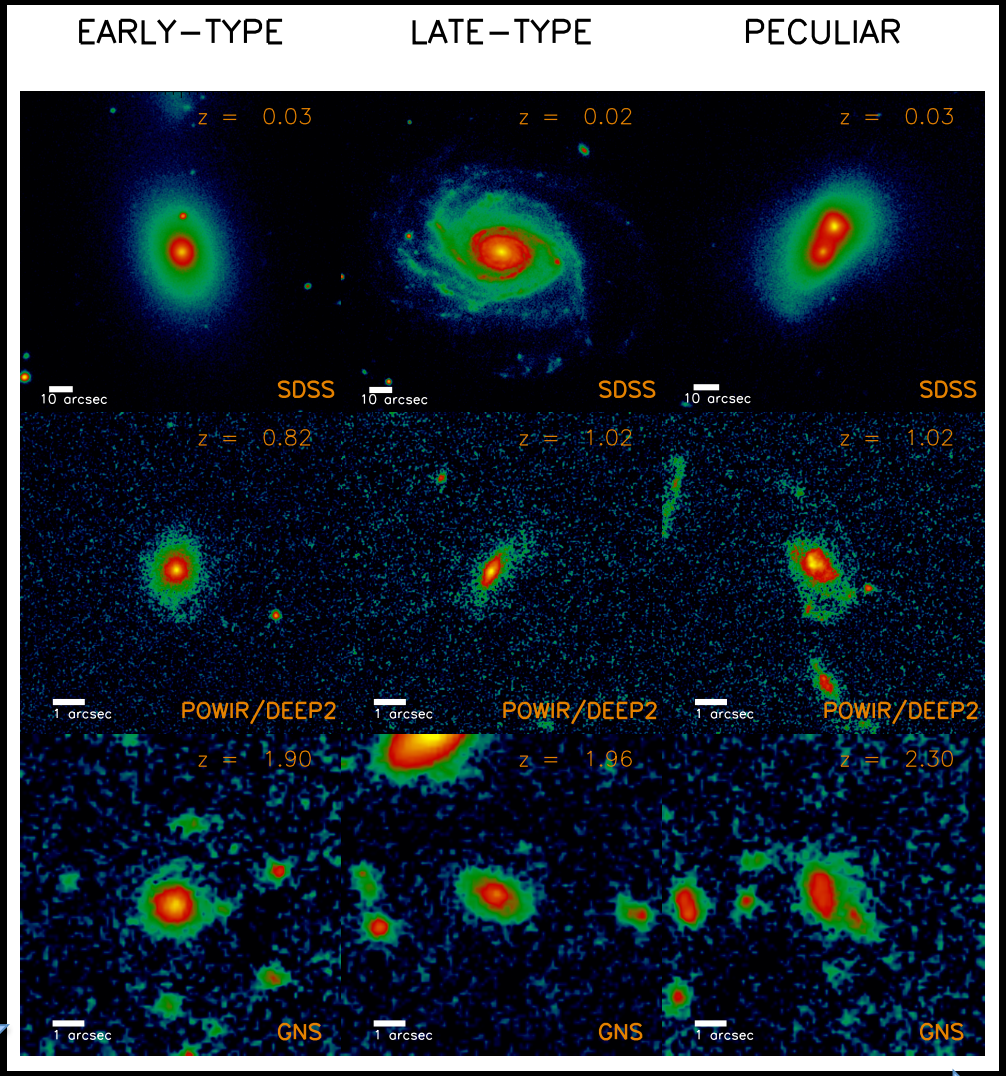


Van der Bergh & Abraham 2001

- Massive galaxies: $M_{stellar} > 10^{11} M_{\odot}$
- Very luminous ➔ Easy to track at high-z
- Dramatic changes ➔ Galaxy evol. Labs
- "King of my castle" ➔ Large baryonic and DM dominates galaxy neighbours
- Galaxy main sequence, red sequence, quenching… ➔ Strong mass dependence



MORPHOLOGY



From Buitrago et al. 2013a

Van der Wel+11, Cameron+11, Oesch+11, Weinzirl+12, Bruce+12, Chang et al. 2013

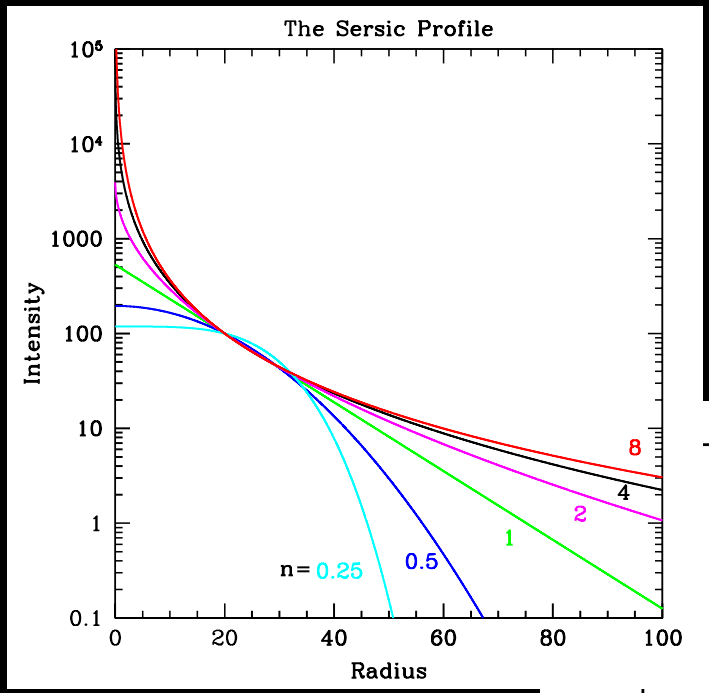
> 1000 massive gals. & > 600 spec-z

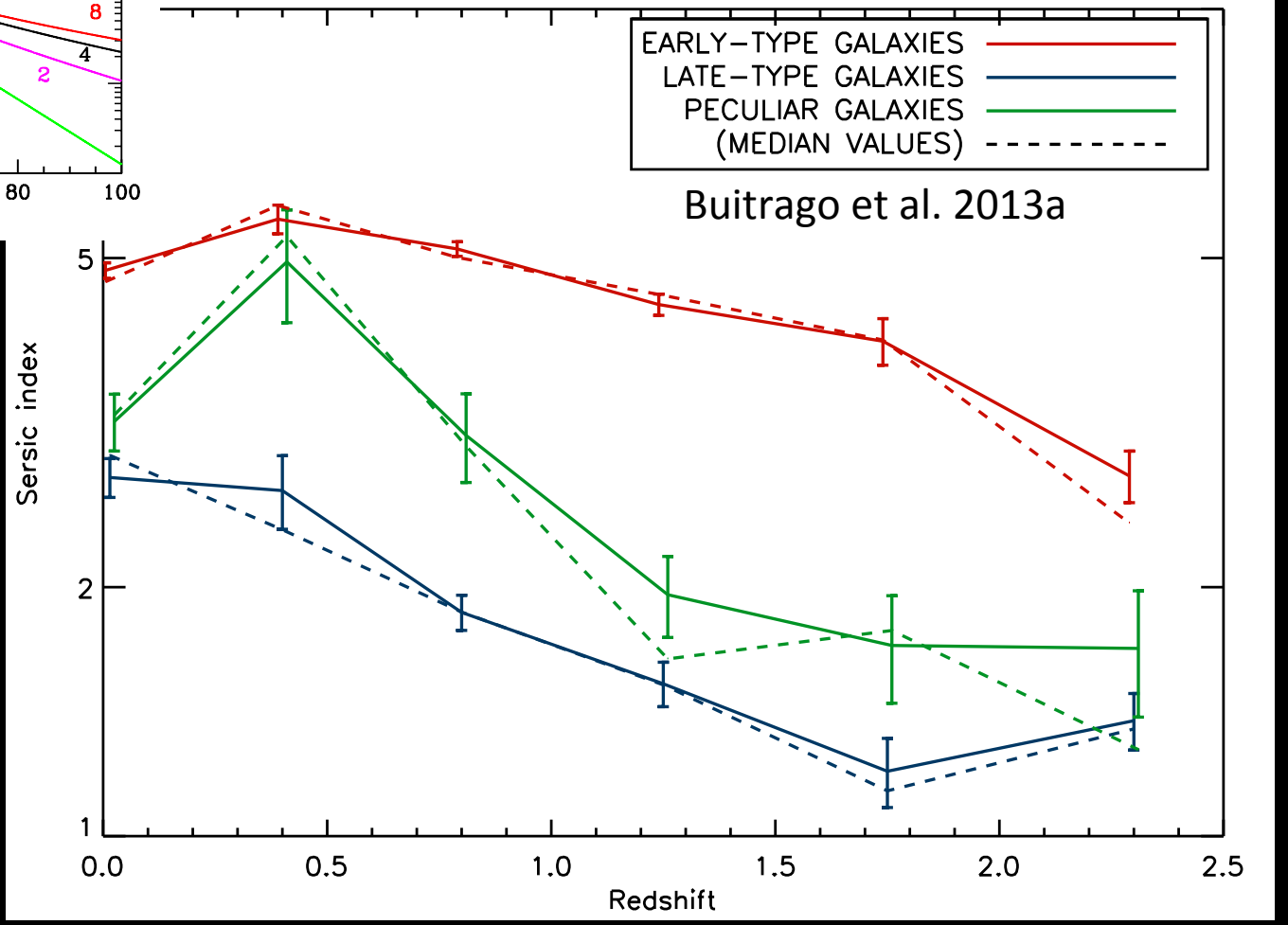
BC+03, Chabrier IMF, exponentially declined SFHs

QUALITATIVE
- Morphological classification
- K-correction

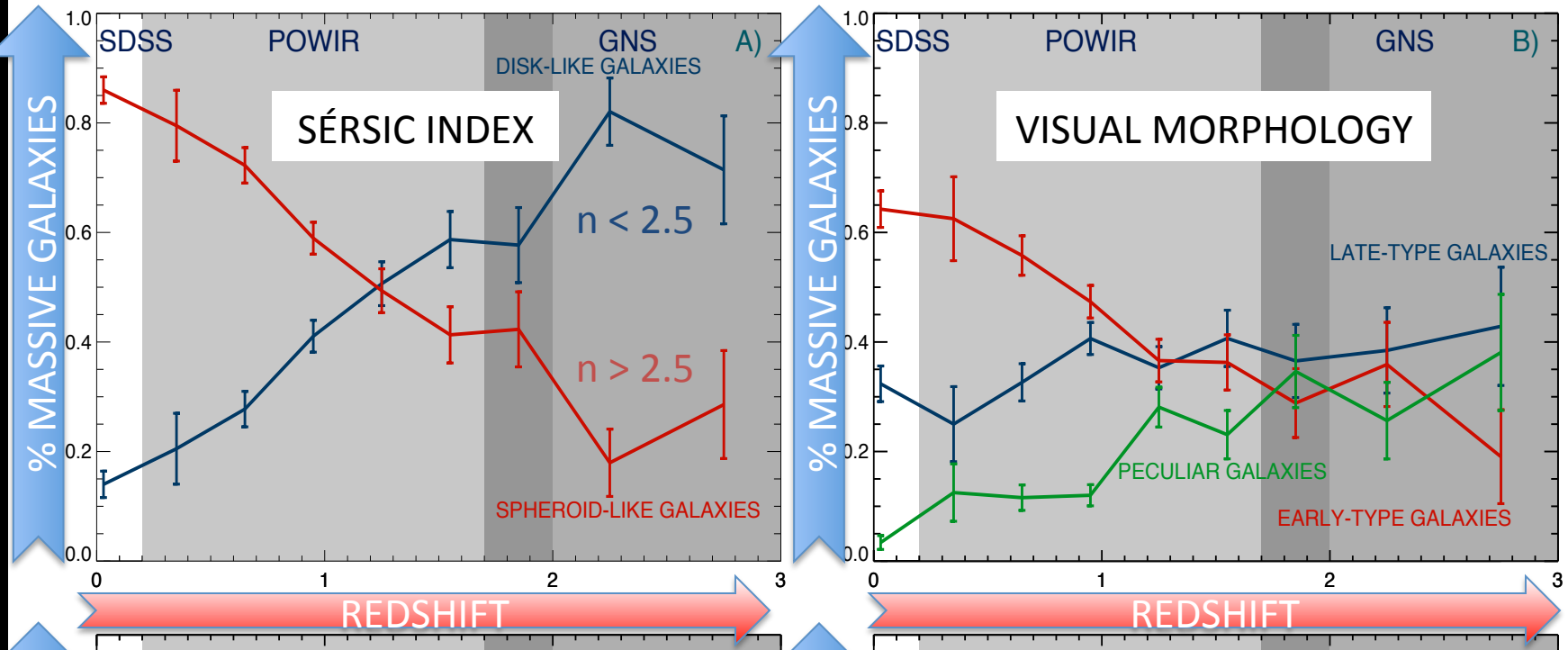
QUANTITATIVE
- Single Sérsic profiles
- Parameter recovery

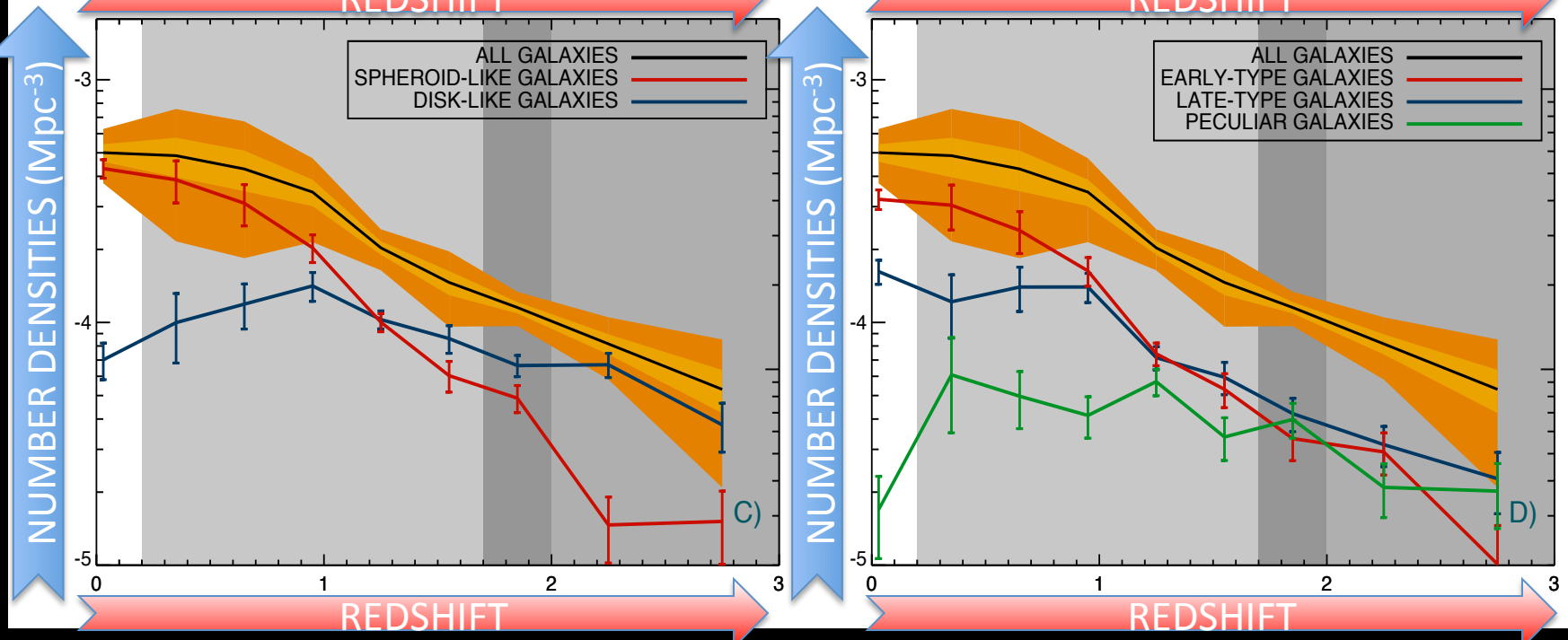
SÉRSIC INDEX



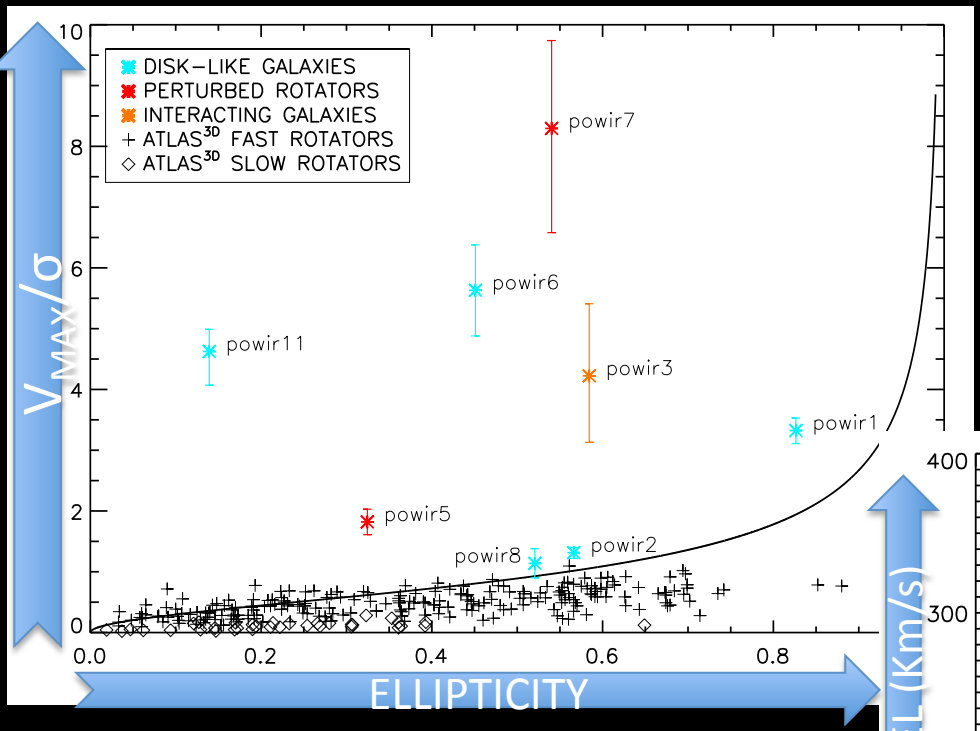


EVOLUTION OF MASSIVE GALAXIES (Buitrago et al. 2013)

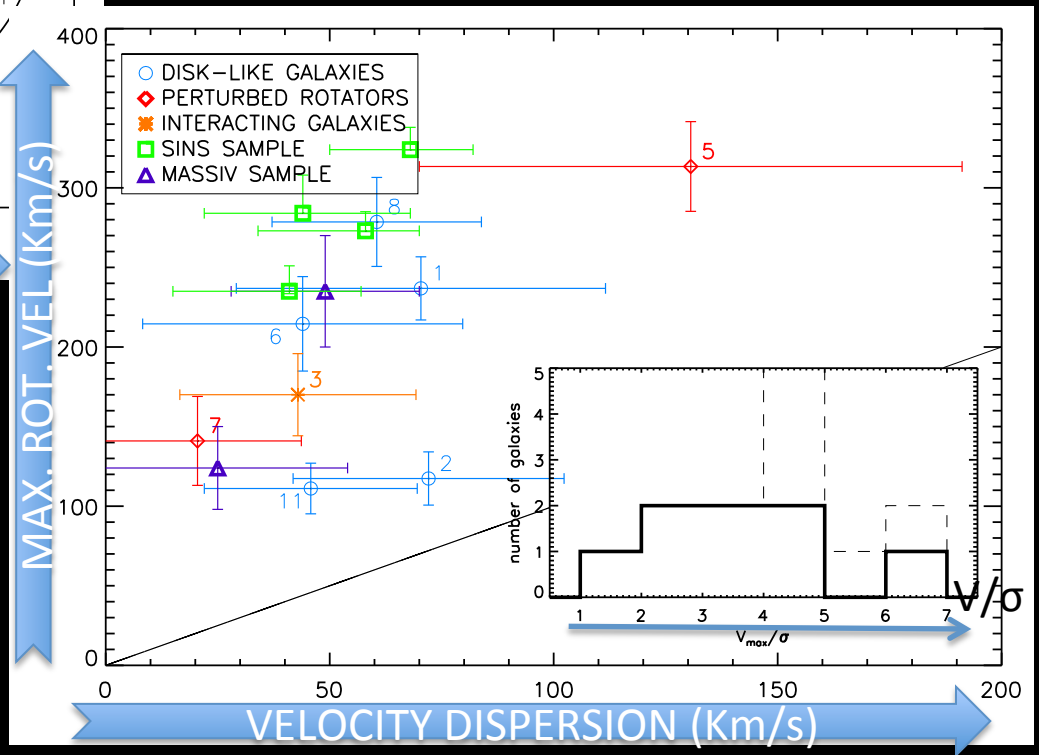




3D SPECTROSCOPY EVIDENCE OF THE MORPHOLOGICAL EVOLUTION

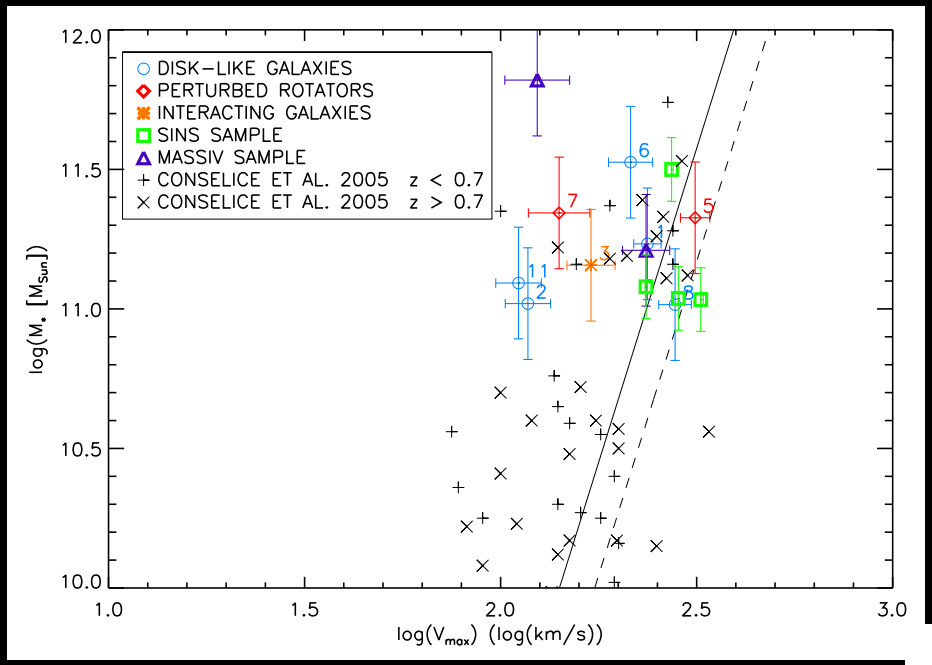


- 10 galaxias @ z=1.4 – transition epoch! –
- Selected by stellar mass & EW[OII] > 15 Å
- K-band POWIR survey & DEEP2 spectra
- SINFONI@VLT H-band
- Modelling according Epinat et al. (2010)



From Buitrago et al. 2013b, arXiv: 1305.0268

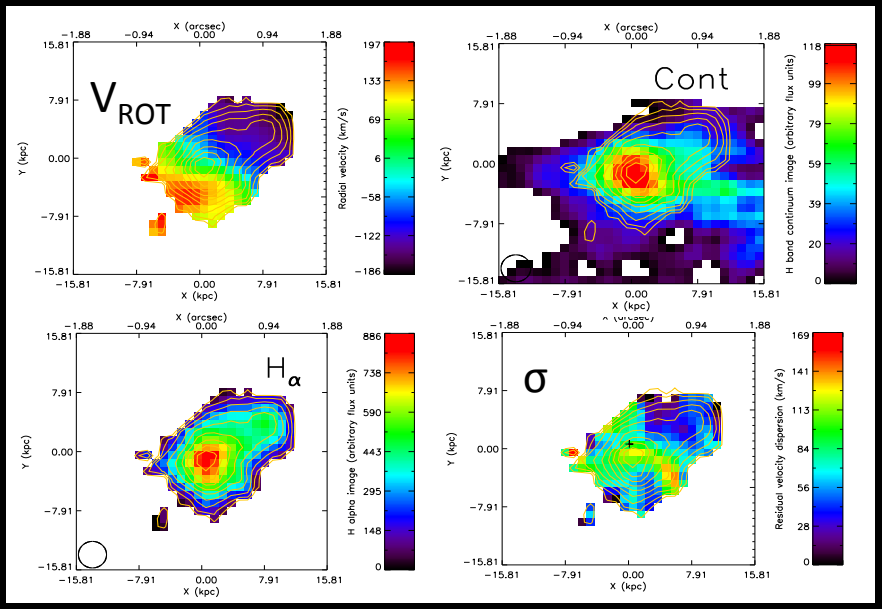
- ✓ 50% compatible with being disks, while all are rotation dominated
- ✓ Morphological downsizing

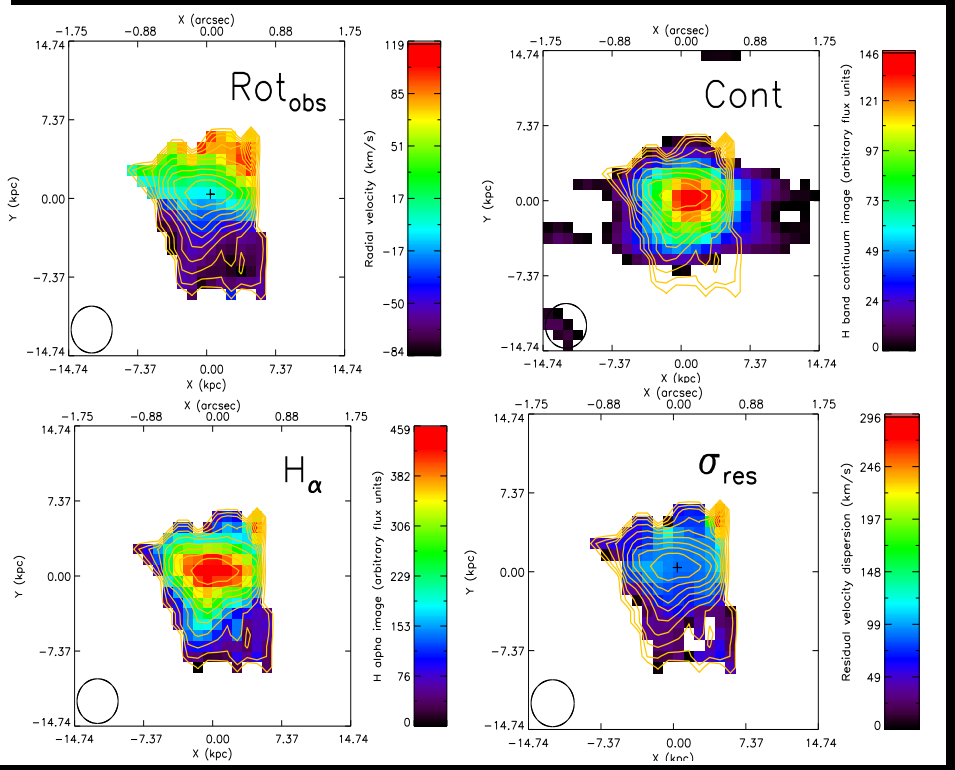


From Buitrago et al. 2013b, arXiv: 1305.0268

+ Tully – Fisher
+ Dynamical masses

Future: surveys with KMOS or MOONS

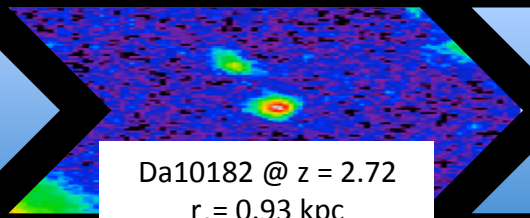




CONCLUSIONS

- Two-phase formation scenario (Naab+09, Oser+10) – mimicking monolithic collapse

From star forming disks



Da10182 @ z = 2.72
r_e= 0.93 kpc
Mass = 1.91x10^{11} $M_\odot$

To red & dead spheroids

M87
Effective radius: 7.4 kpc
Mass > 10^{11} $M_\odot$

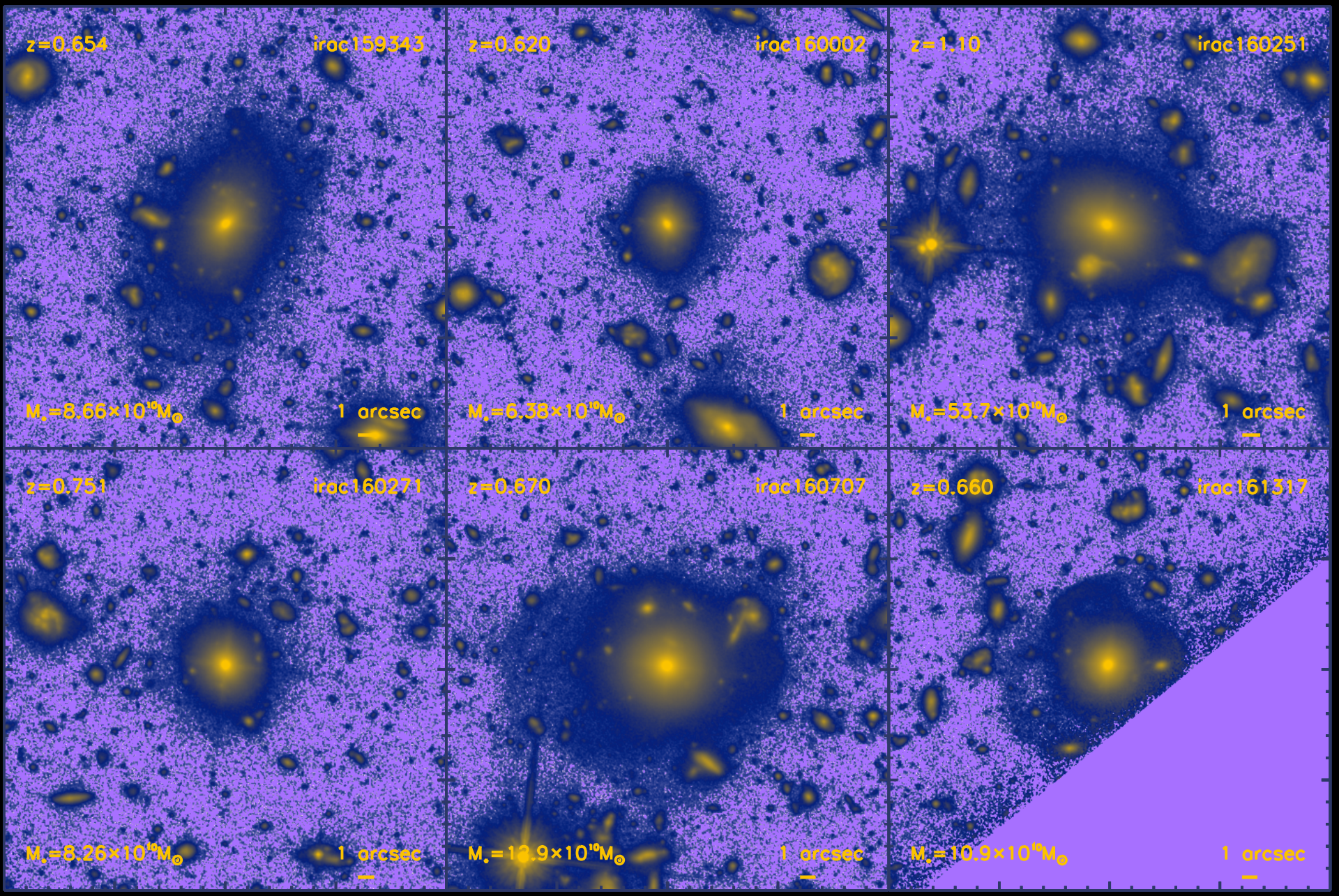
- Still many ?s: how quenching takes place? are they the same agents the ones that produce the size evol., morph. evol. and quenching?
- Where do they end up at z=0? BCGs cores (Hopkins+09, Bezanson +09) vs Local compact galaxies (Trujillo+09, +12, Poggianti+12)
- The importance of being idle/earnest, i.e., minor/major mergers
- If we agree on the evolution mechanisms, the assembly history must be imprinted in the outskirts – some pioneering works (Coccato+10, La Barbera+12, Crnojević+12 & P. A. Duc work) – and hidden clues, so...

How faint can we go?

HUDF12
Ellis et al.
2012
Koekemoer
et al. 2012

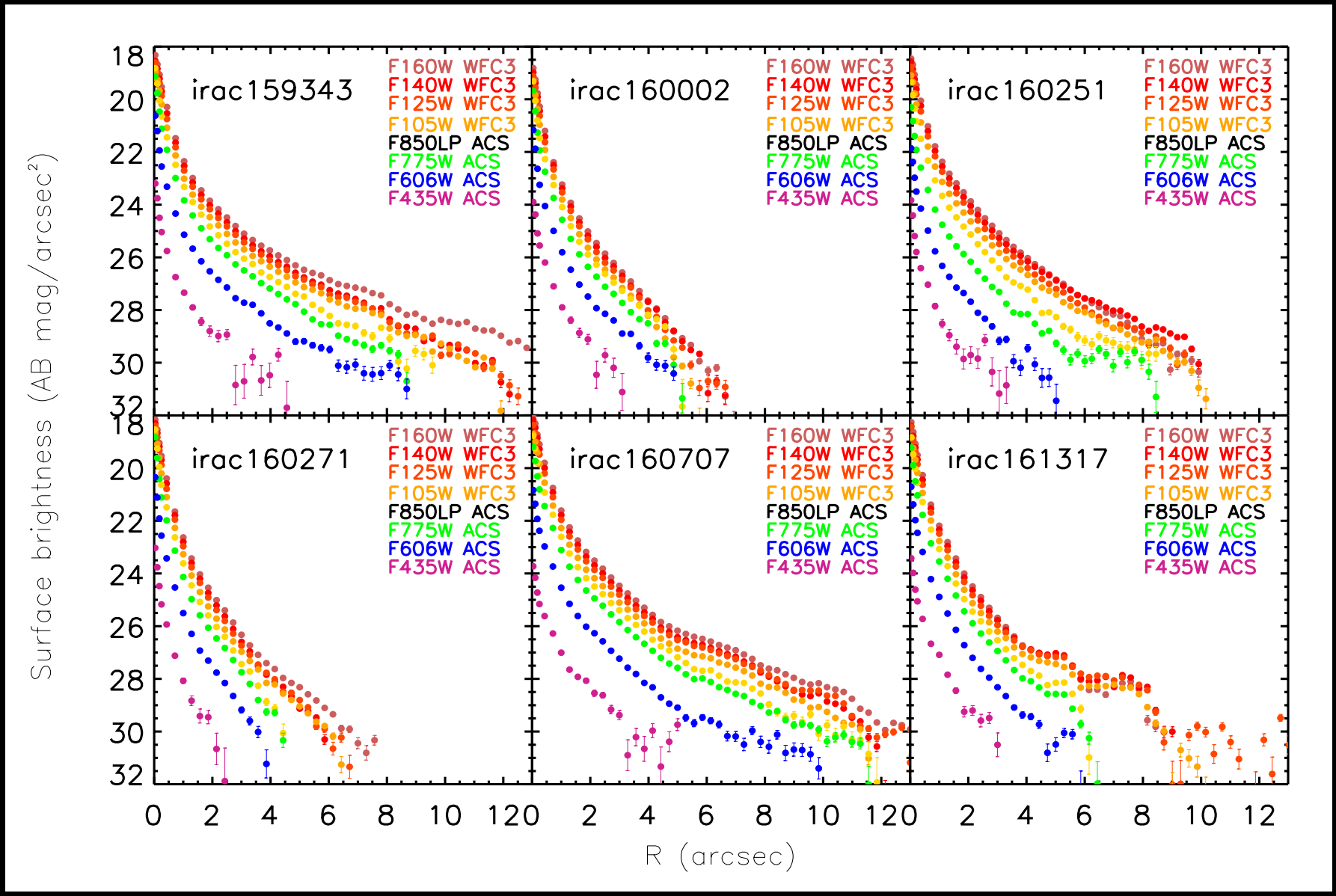
+ ACS
optical
coverage

+ local
Universe
see Esther
Marmol
talk about
SDSS IAC
Stripe 82
Legacy
Survey

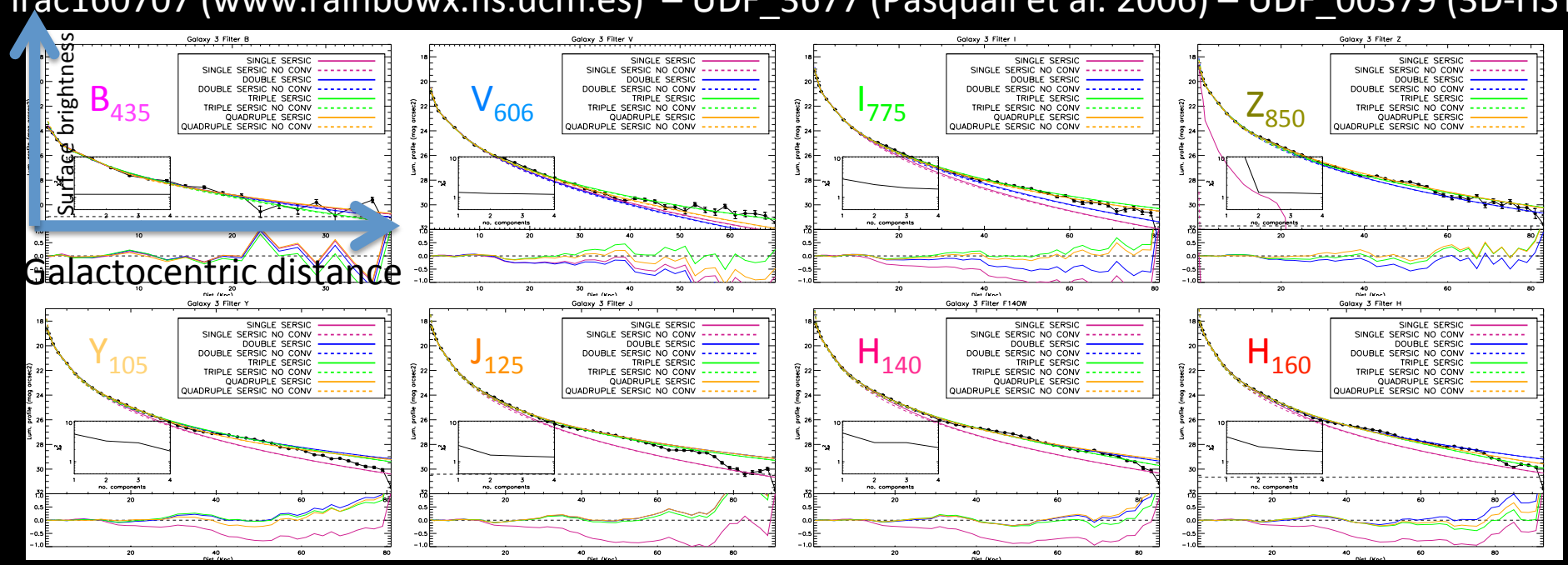


Mag. range displayed is 18-30. Masses assuming Salpeter IMF

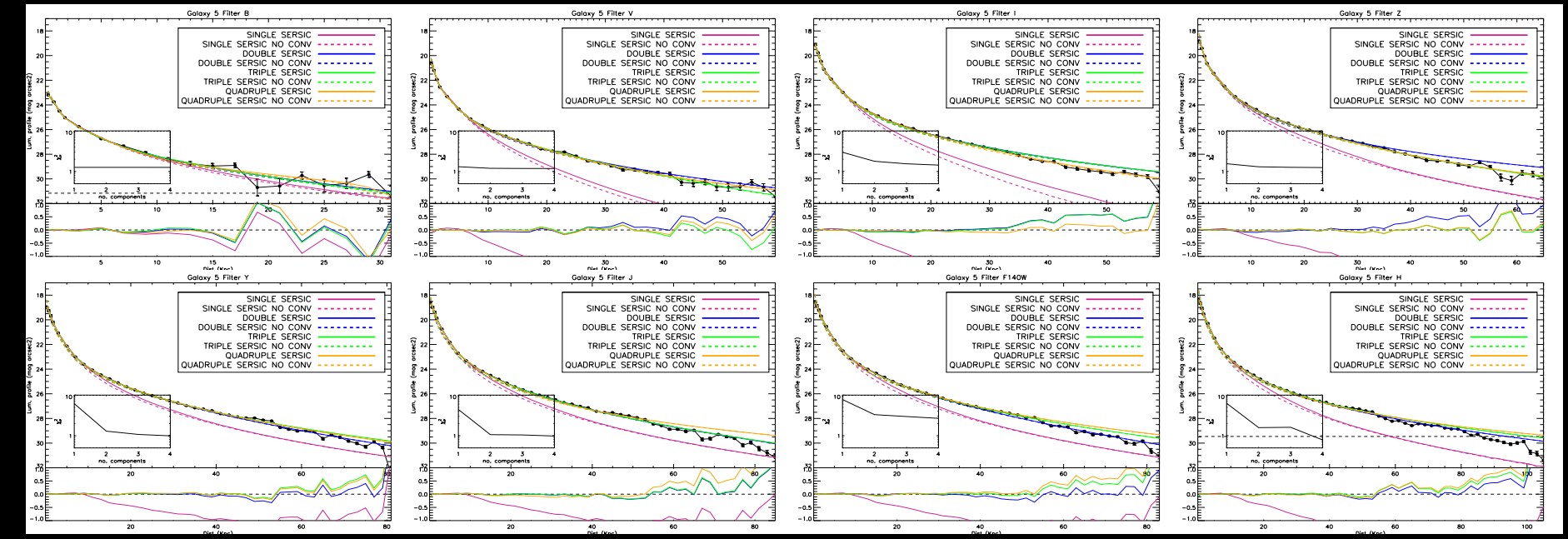
OBSERVED SURFACE BRIGHTNESS PROFILES



irac160707 (www.rainbowx.fis.ucm.es) – UDF_3677 (Pasquali et al. 2006) – UDF_00379 (3D-HST)

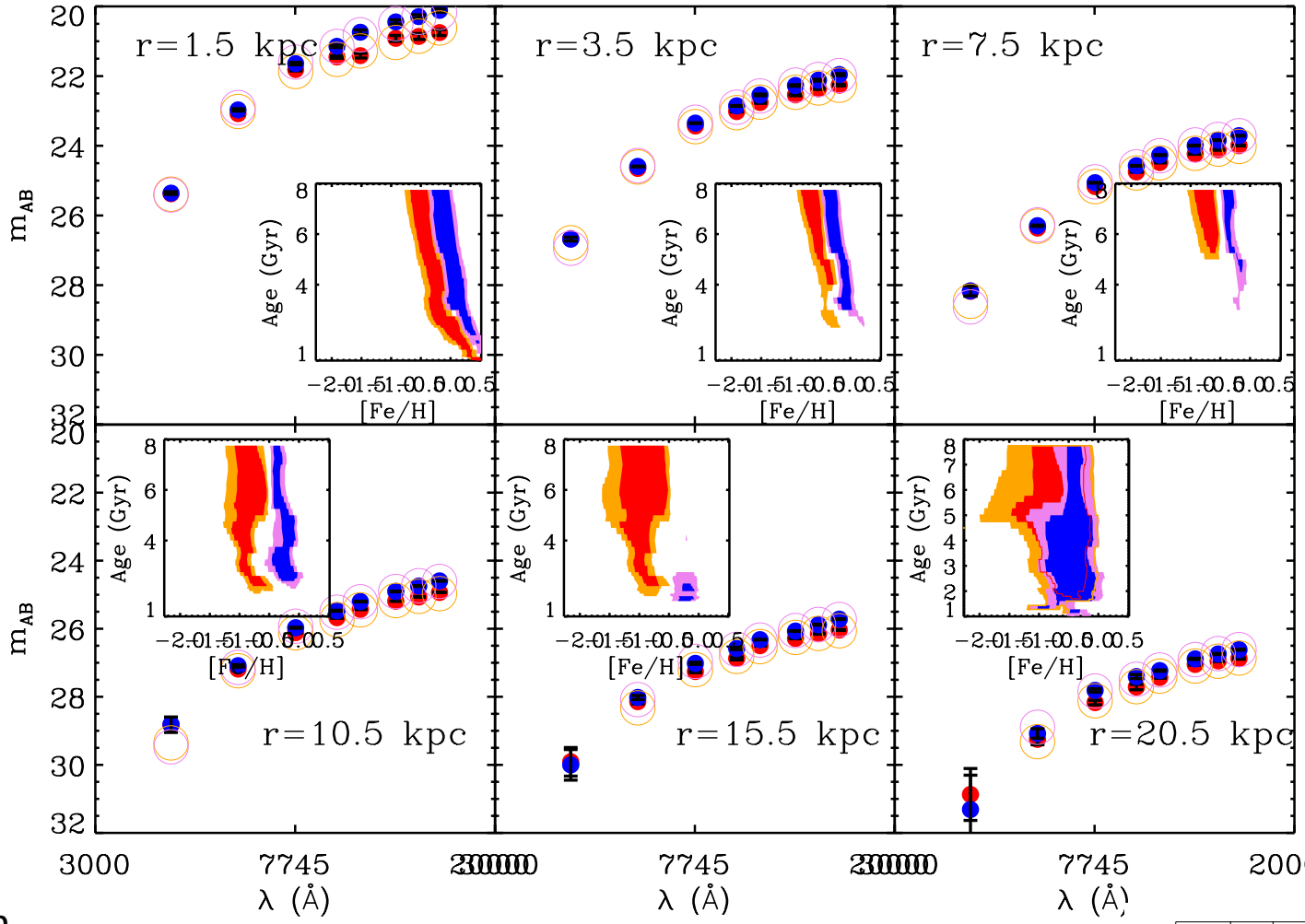


irac159343 (www.rainbowx.fis.ucm.es) – UDF_4527 (Pasquali et al. 2006) – UDF_00579 (3D-HST)

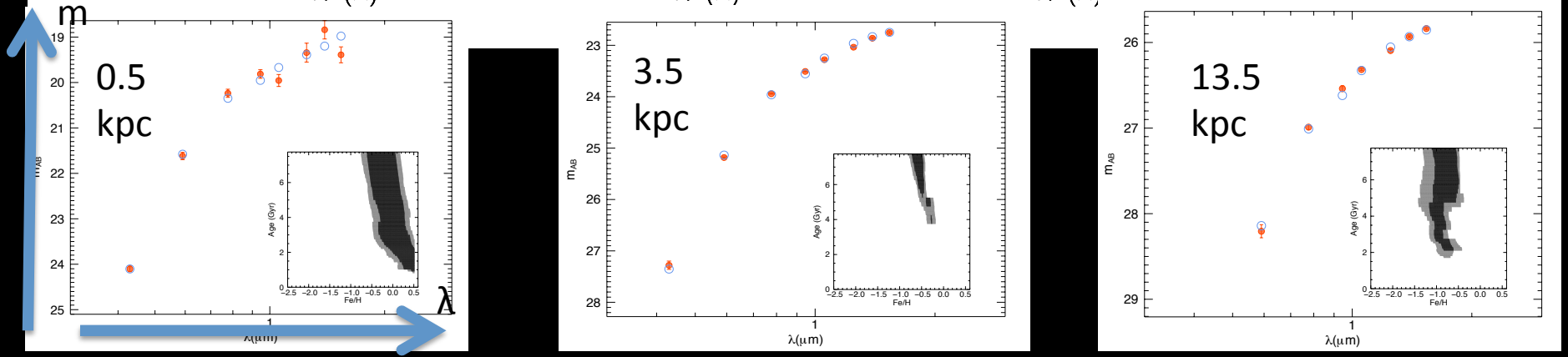


STELLAR POPULATIONS STUDY

- Multi-Sersic analyses to overcome the PSF impact (cannot claim physical nature, as in Trujillo & Bakos 2012, but hopefully KMOS data – also for the satellites –)
- Profiles using deconvolved galaxy plus residuals (Szomoru+12) for age & metallicity gradients
- “Touching from a distance” – Up to > 20 r_e or ~100 Kpc => like local studies but at z = 0.6 - 1



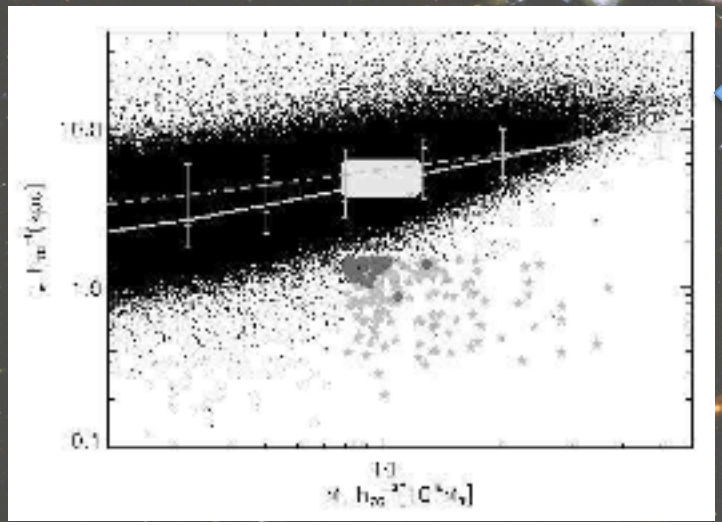
Work in progress



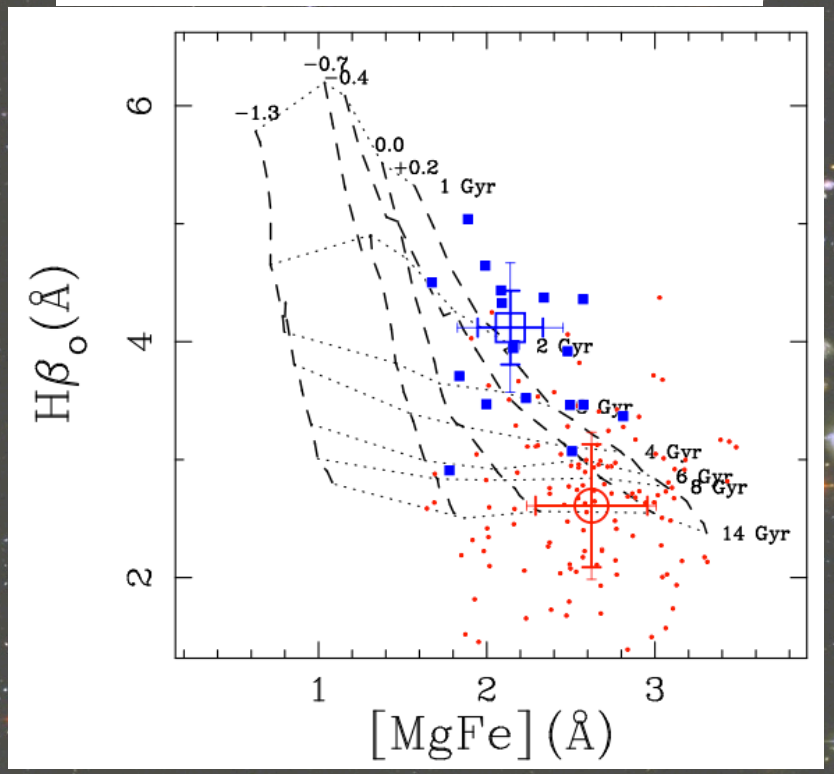
TAKE AWAY CONCLUSIONS

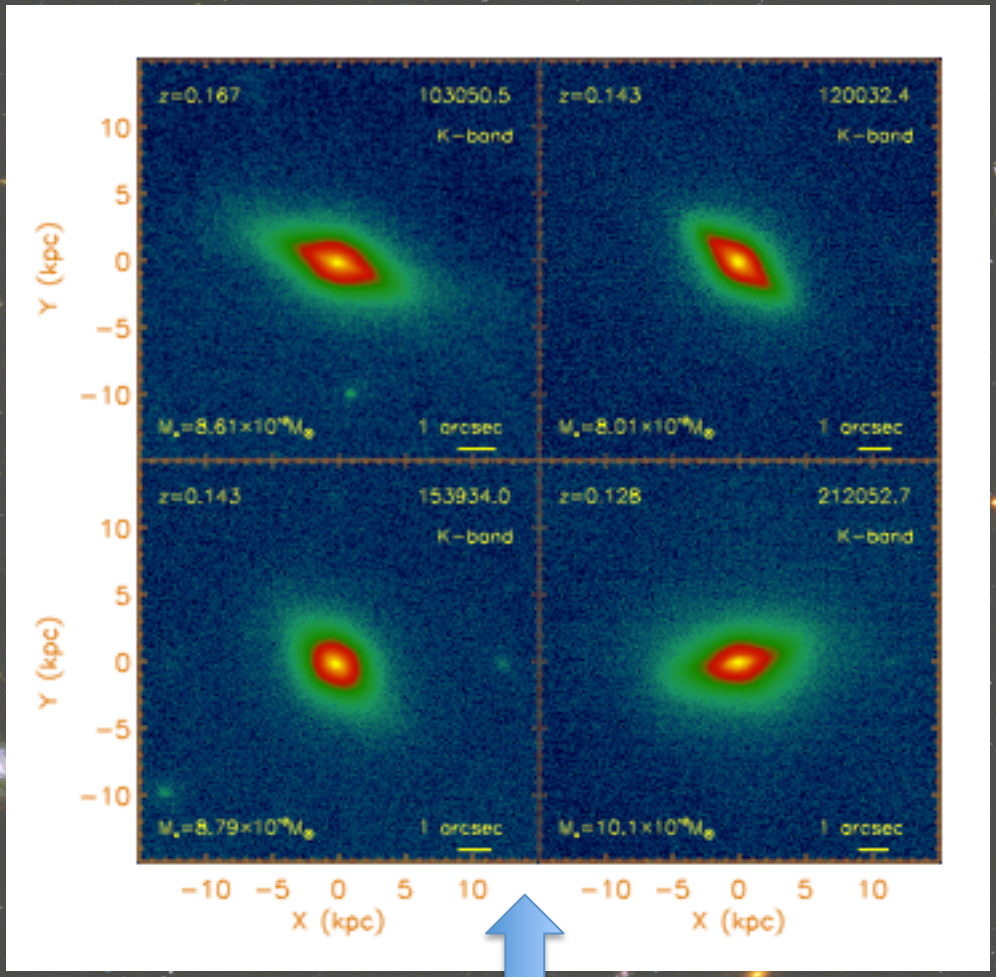
- Massive galaxies help constraining ΛCDM
- At z = 0 they are mainly described by large early types, but at z = 2-3 late/peculiars
- 3D-spectroscopic evidence of their rotational support at z=1.4
- HUDF12 unveils to an unprecedented depth (>20 R_e) the mass assembly of massive ETGs

LOCAL & COMPACT MASSIVE GALAXIES



Trujillo+09

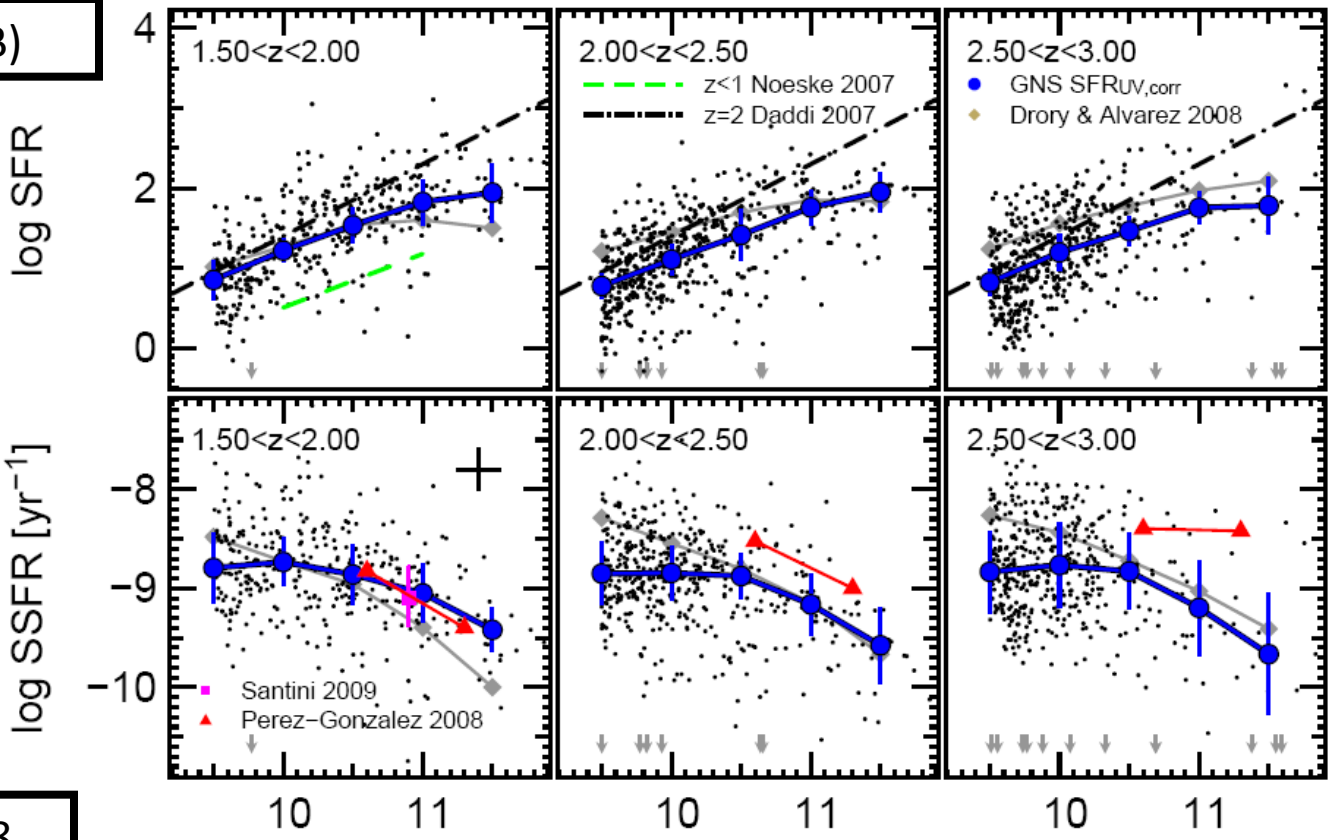




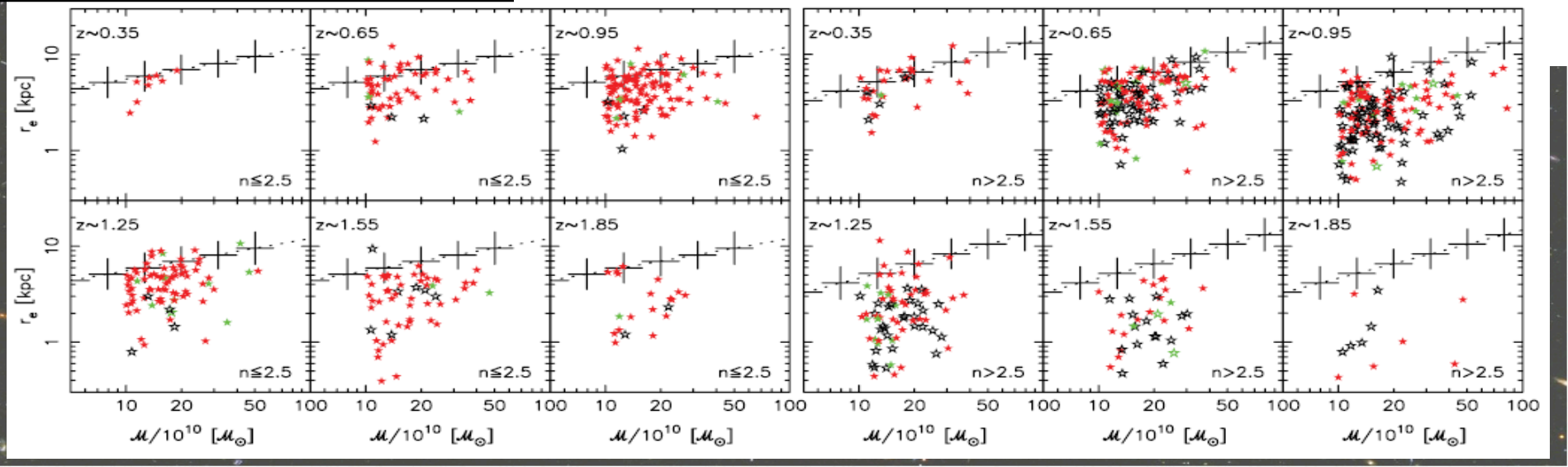
Trujillo+12, Ferré-Mateu+12

Bauer et al. 2011 (+FB)

But whatever is causing the quenching should be fast (Twite et al. 2010 +FB)



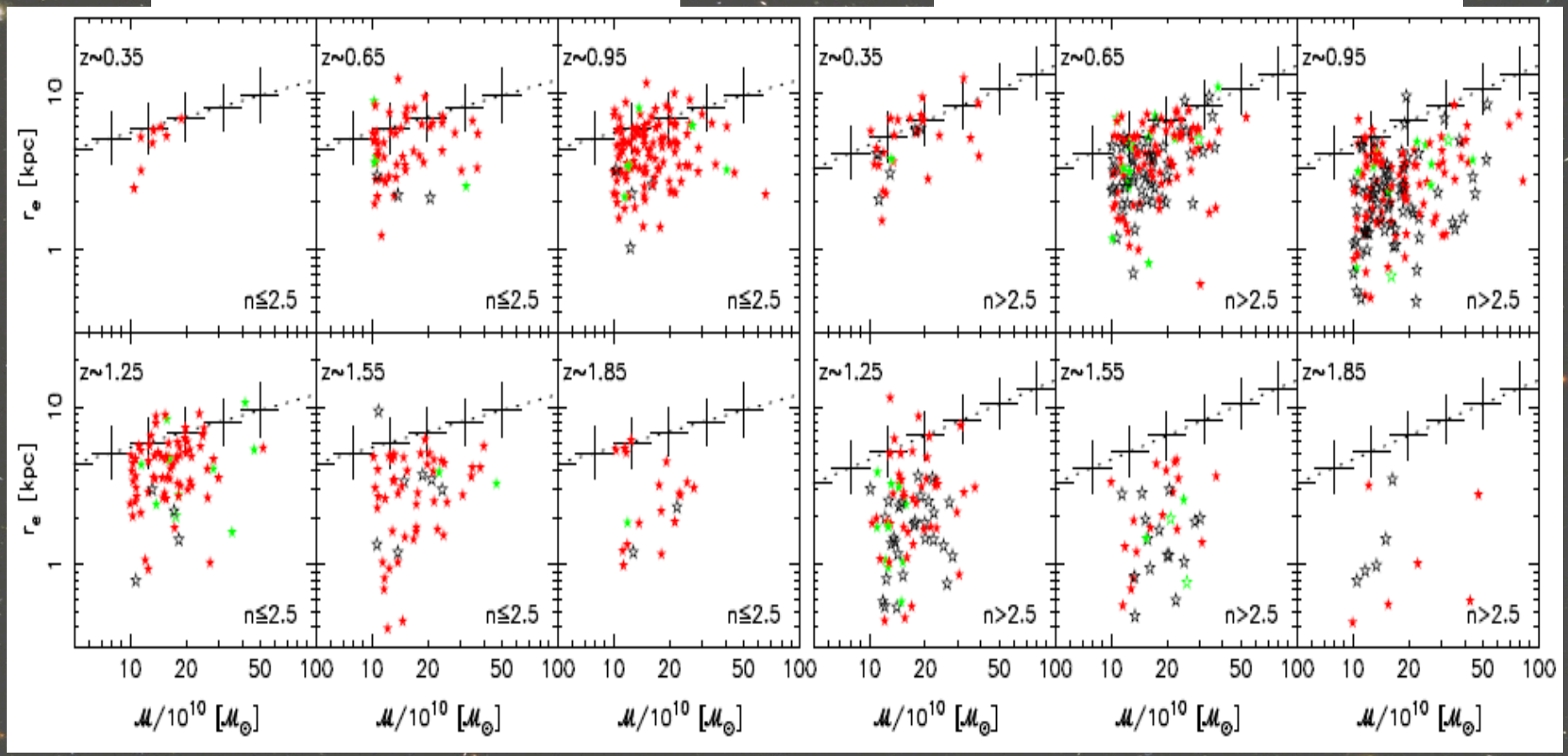
Pérez-Gonzalez et al. 2008



STAR FORMATION IN MASSIVE GALAXIES

Disk-like objects

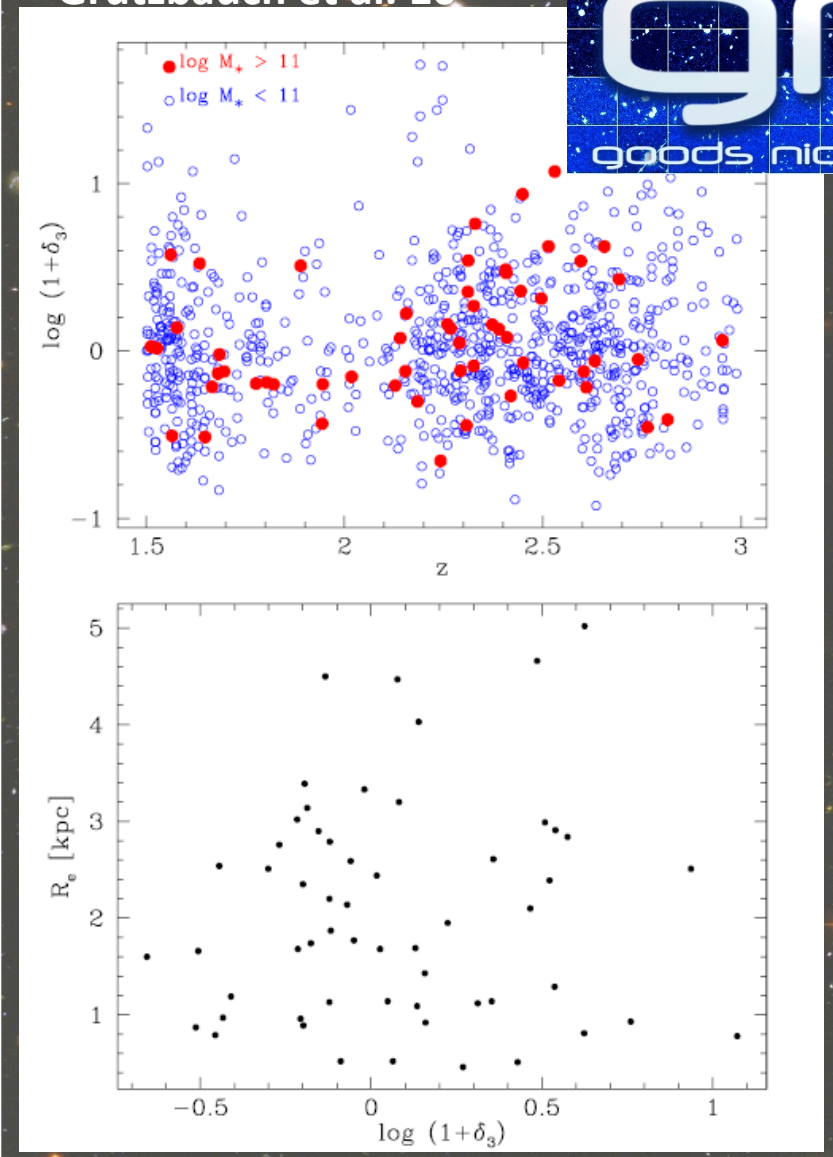
Spheroid-like objects

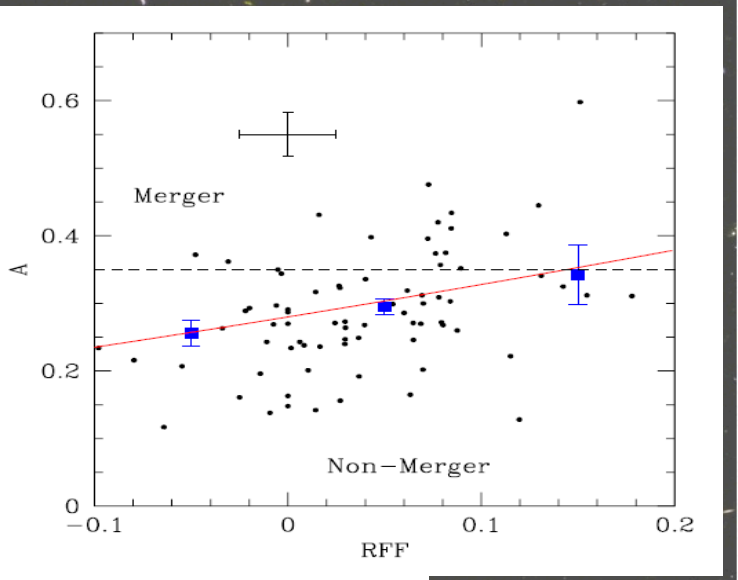


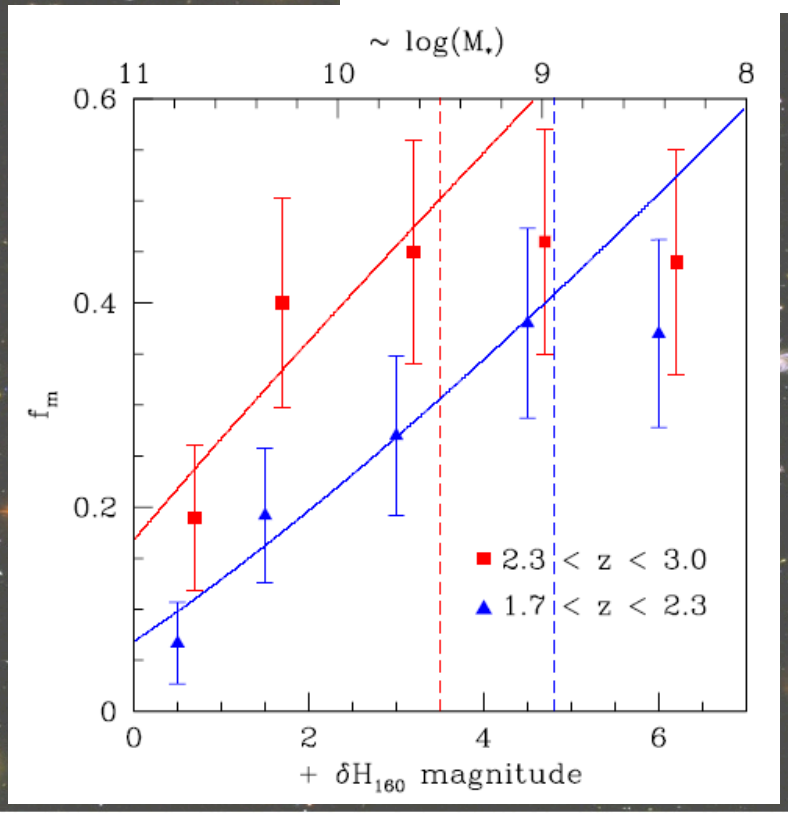
Pérez-González et al. 2008

MASSIVE GALAXIES IN ...

Grützbauch et al. 10







Bluck et al. 11, arXiv: 111.5662