Properties of disks in isolated galaxies

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AMIGA Analysis of the Interstellar Medium of Isolated GAlaxies

Flagstaff , 8th October 2014

Properties of disks in isolated galaxies

The stellar mass-size relation

Growth in size of early and late-type galaxies since z=2-3 (Trujillo et al. 2007) caused by:

- "Dry" minor mergers (Bell et al. 2005, van Dokkum 2005)
- Expansion driven by quasar feedback (Fan et al. 2008), stellar winds and supernova explosions (Franx et al. 2008)

Environmental studies of the stellar mass-size relation

- No dependence (Rettura et al. 2008, Huertas-Company et al. 2013), cluster galaxies more compact (Poggianti et al. 2013), less compact (Cooper et al. 2012)
- Low-mass spirals: slight trend to be larger in the field (Maltby et al. 2010)

Isolated galaxies → the growth in size, is affected by the environment?

The AMIGA project

Analysis of the interstellar Medium of Isolated Galaxies

Catalogue of Isolated Galaxies (CIG) – 1051 (Karachentseva 1973)

No major tidal interaction within the last ~3Gyr

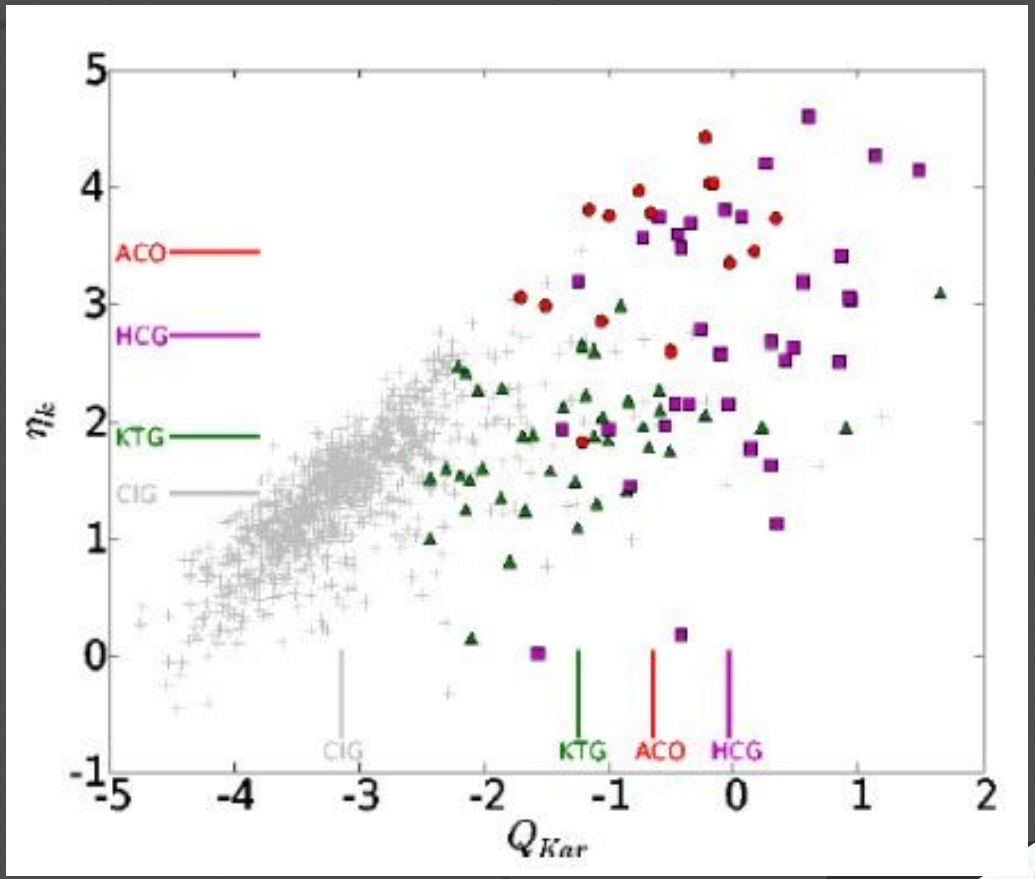
Galaxies present different levels of isolation

- ➢ Local number density η_K
- ➢ Tidal force estimation Q

Revised catalogue, N = 791

Q < -2 (1% binding forces)

η_K < 2.4



(Verley **PhD**; Verley+ 2007ab)

Properties of disks in isolated galaxies

The stellar mass-size relation (Fernández Lorenzo+ 2013)

DR8 images of all AMIGA galaxies in SDSS (N ~ 800)

- Mask of the stars
- Determination of parameters with SExtractor
- Ks-band photometry of 2MASS
- We calculated stellar masses using k-correct (Blanton & Roweis 2007)

Sample selection:

- Galaxies that follow the isolation criteria of Verley+ (2007)
- Completeness criteria: mag B<15.3 (~mag r<14.5)
- 452 galaxies follow these conditions

Properties of disks in isolated galaxies

The stellar mass-size relation

(Fernández Lorenzo+ 2013)

Two size estimators (i-band):

- Half-light radius given by SExtractor
- Effective radius obtained by fitting Sérsic function with Galfit

  ⇨ Good agreement for early-types with 2.5<n<4.5 and late-types with 0.5<n<2.5

Sample of comparison:

- Stellar mass-size relations of Shen+ (2003)

Properties o ies

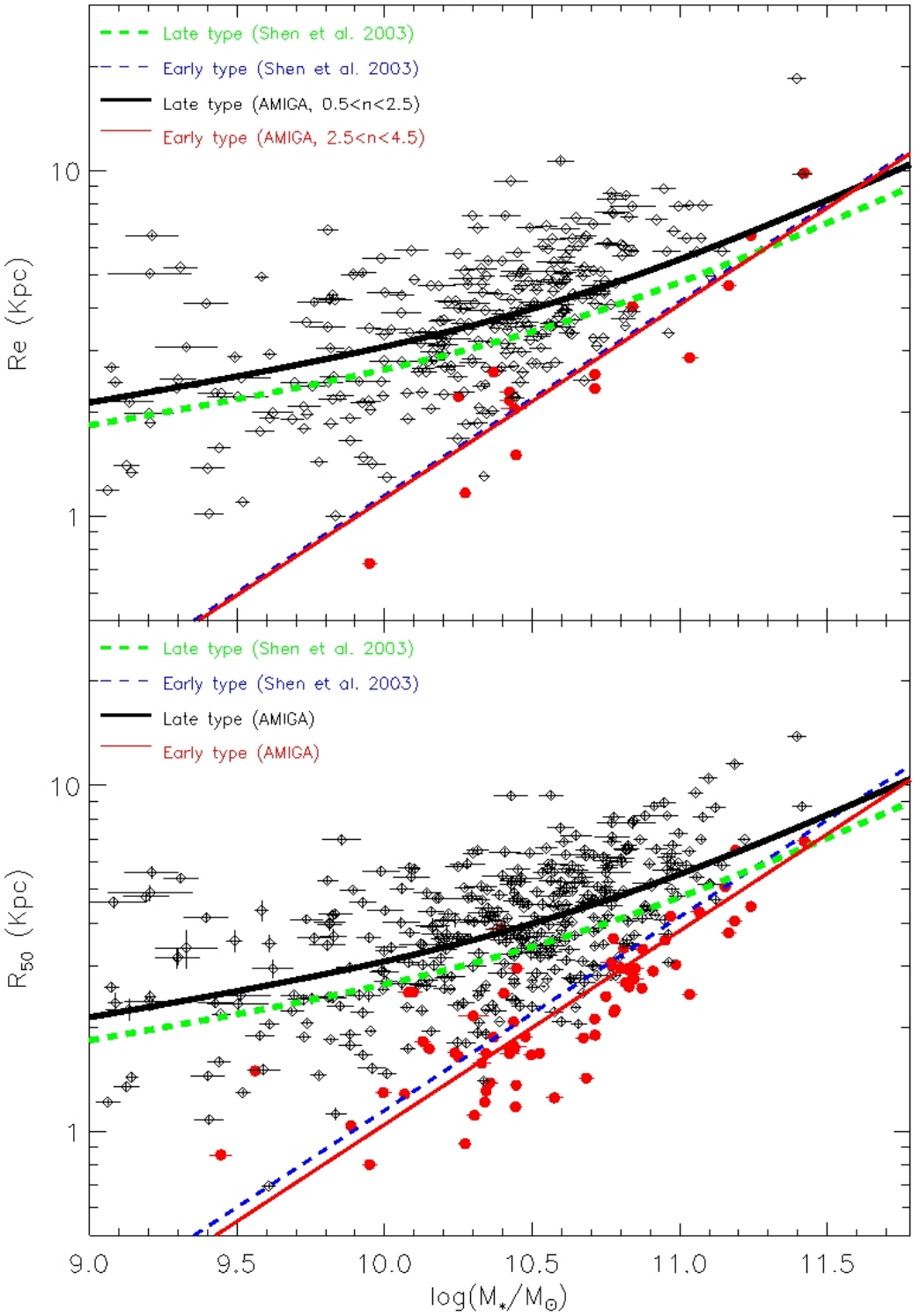
The stellar mass nández Lorenzo+ 2013)

Two size estimato h Galfit

- ✶ Half-light radi
- ✶ Effective radiu
  - ⇨ Good agree d late-types with 0.5<n<2.5

Sample of compar

- ✶ Stellar mass-s



Properties of disks in isolated galaxies

The stellar mass-size relation (Fernández Lorenzo+ 2013)
as function of the morphological type

The comparison between samples analyzed in a different way should be treated with special care:

- Offset in the mass used by Shen with respect to kcorrect masses
- Sizes from the NYU-VAGC catalog in the z-band
- Morphological classification

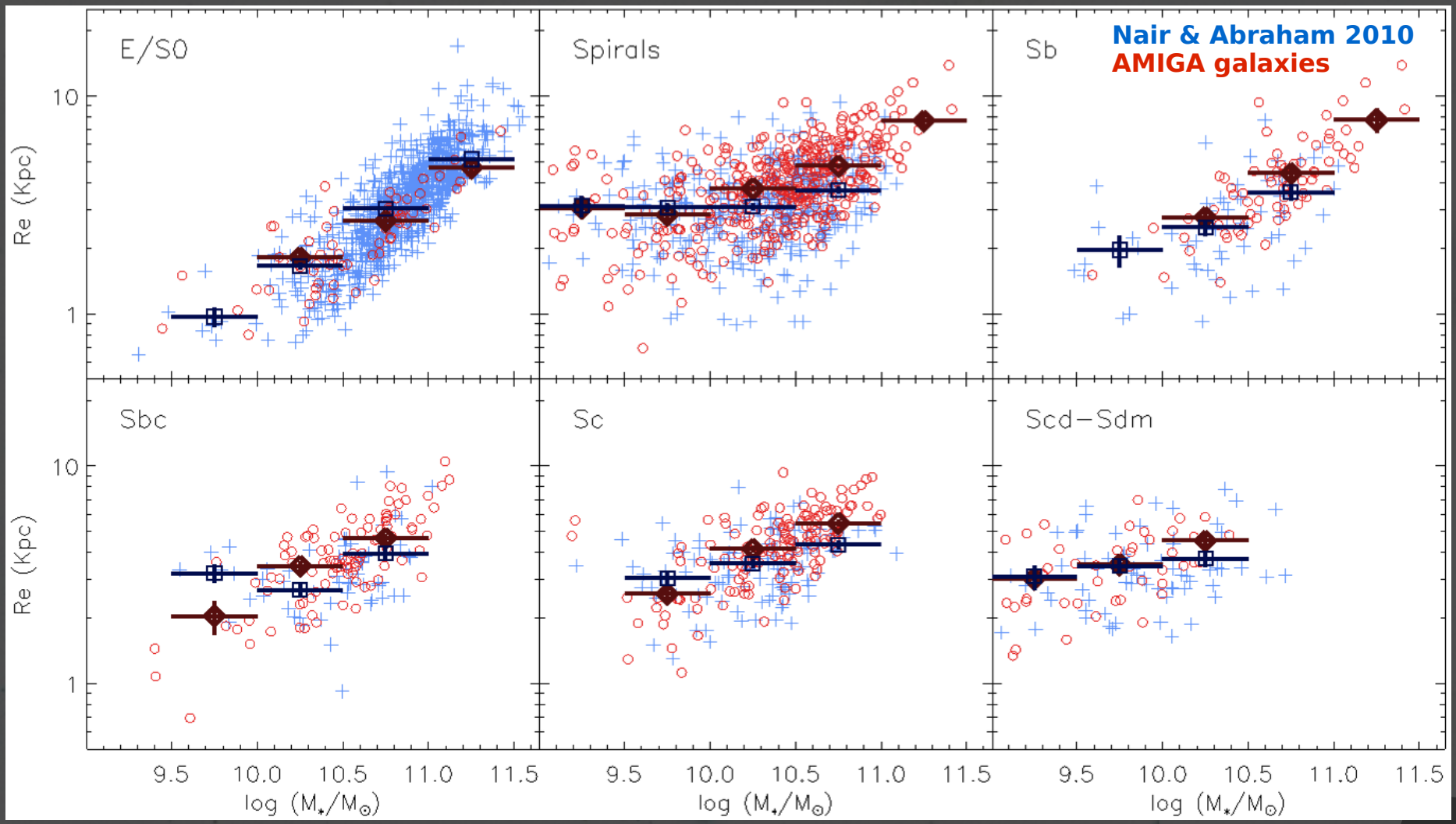
Sample of comparison:

- Nair & Abraham (2010) – Morphological classification available
- NYU-VAGC catalog – Sérsic fit to galaxies in the Nair+ sample
- Photometry from DR8 – stellar masses calculated with kcorrect

Properties of disks in isolated galaxies

The stellar mass-size relation
as function of the morphological type

(Fernández Lorenzo+ 2013)



Properties of disks in isolated galaxies

The stellar mass-size relation (Fernández Lorenzo+ 2013)

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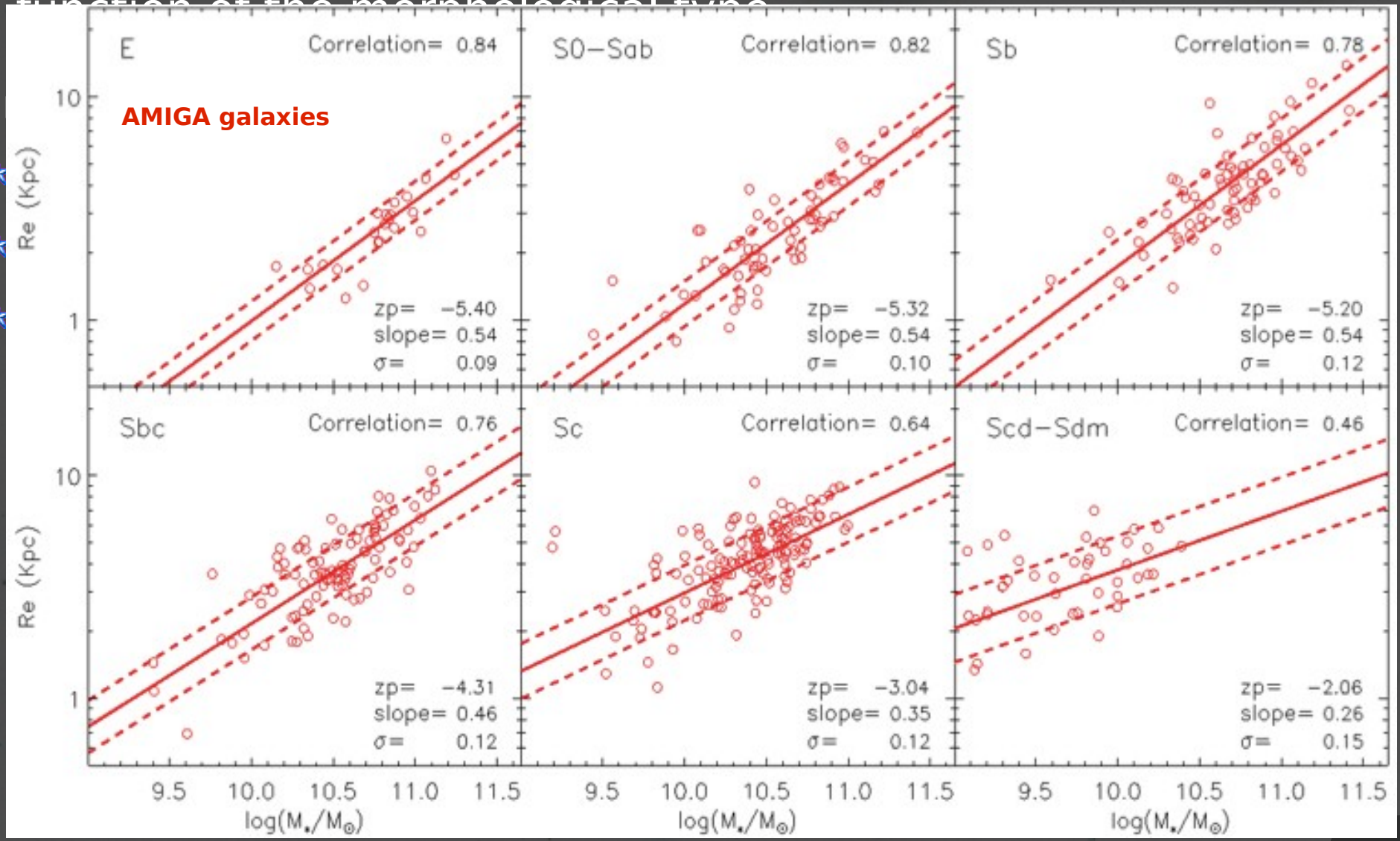

Properties of disks in isolated galaxies

The stellar mass-size relation (Fernández Lorenzo+ 2013)

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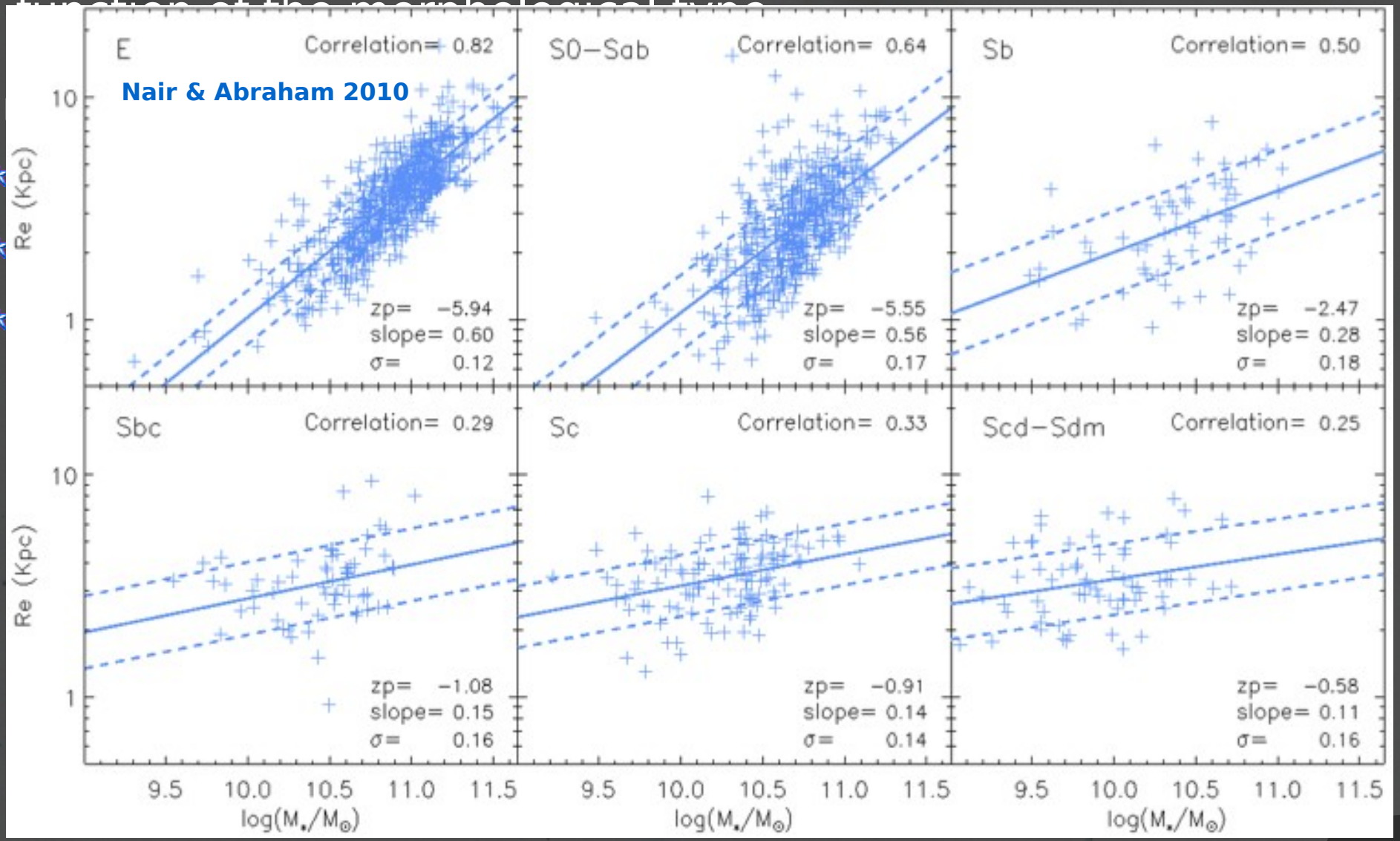


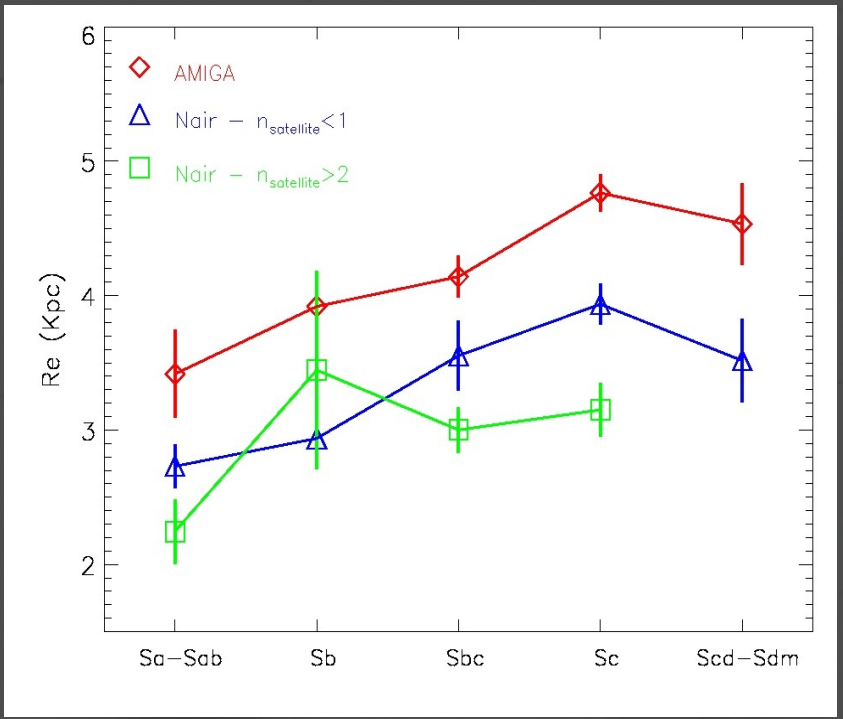
Properties of disks in isolated galaxies

The stellar mass-size relation
Small and large scale environments

(Fernández Lorenzo+ 2013)

Mean size as function of the number of satellites (250 kpc):
(10<log(M_*)<11)

- Larger than galaxies with none or 1 satellite in other environments
- Larger difference with galaxies with 2 or more satellites

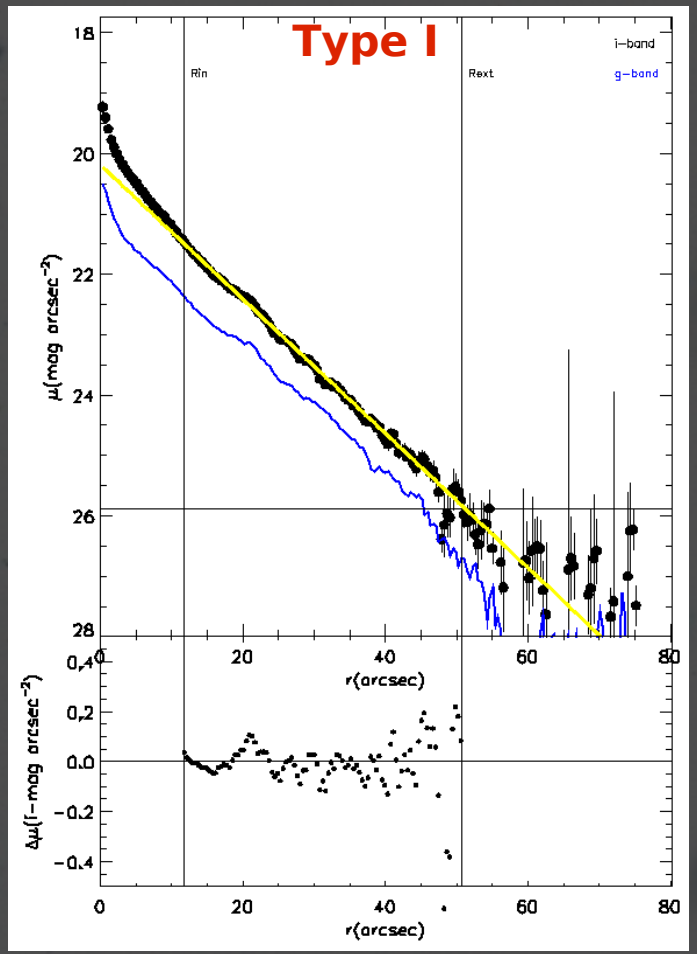


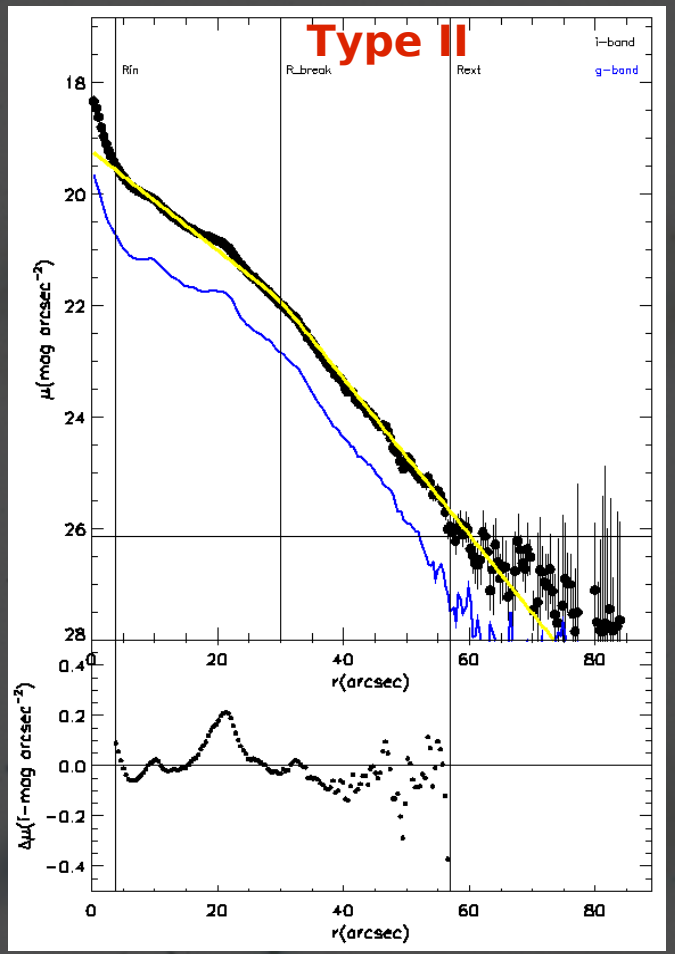
Massive spirals located in low dense environments are larger than galaxies in denser environments and also the satellites affects the size of galaxies

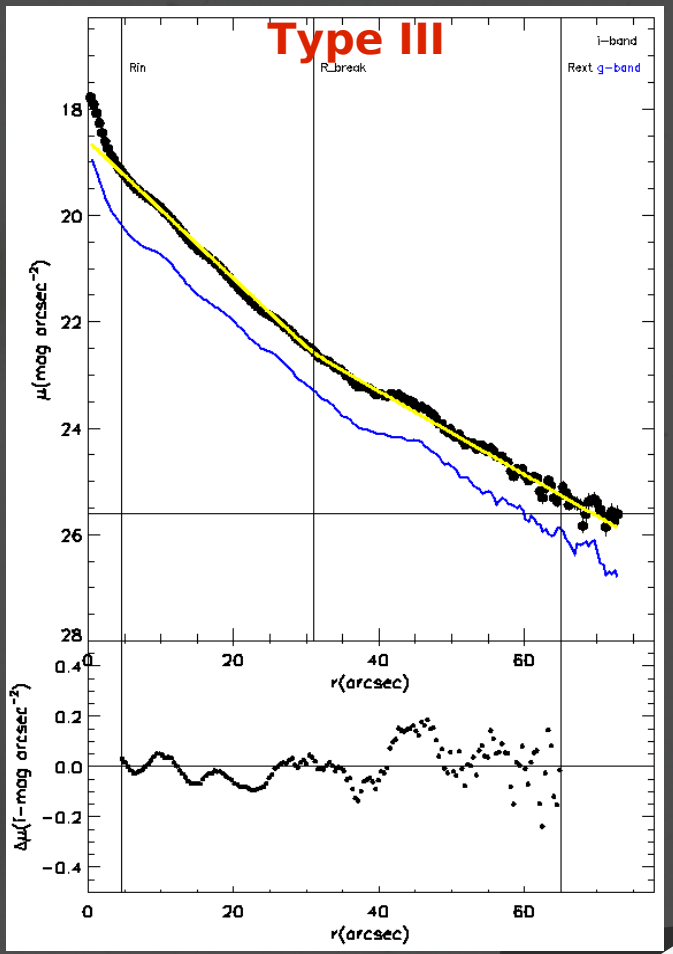
Properties of disks in isolated galaxies

(Fernández Lorenzo+ 2014, in prep.)

But, how is the environment affecting the size of disks?
How are the exponential disks of our galaxies?







Properties of disks in isolated galaxies

(Fernández Lorenzo+ 2014, in prep.)

Initial sample: 261 galaxies (16 have more than one break)

Total galaxies	Type I	Type II	Type III
245	51%	33.1%	15.9%

	Laine+2014	Gutierrez+2011	Polhen & Trujillo 2006
Type I	32%	21%	11%
Type II	49%	50%	66%
Type III	21%	38%	33%

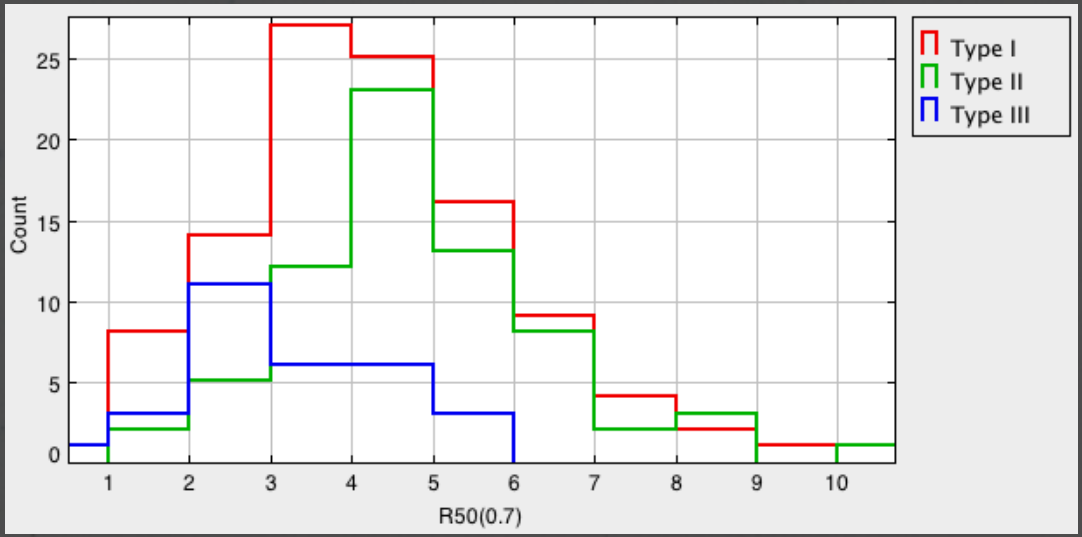
Only galaxies with μ deeper than 26 r-mag/arcsec^2 and inclination lower than 70º:

Total galaxies	Type I	Type II	Type III
170	48.8%	39.4%	11.8%

Properties of disks in isolated galaxies

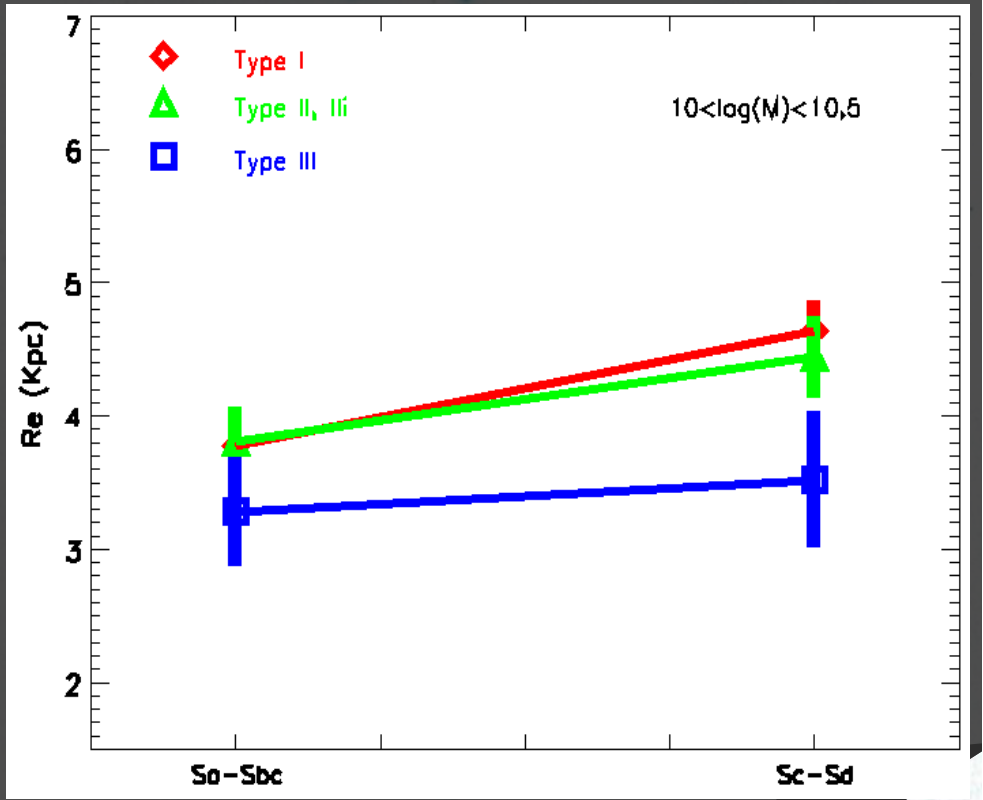
(Fernández Lorenzo+ 2014, in prep.)

Half-light radius for each type:



Type III tend to have smaller Re

Fraction of Type I with small Re



$10<\log(M_*)<10.5$

Similar size for type I and II

Smaller size for type III

Summary

- Growth in size of galaxies independent on the environment
- Massive isolated spirals are 1.2 times larger than galaxies in denser environments
- The satellites also affects the size of spiral galaxies
- 50% of isolated spiral galaxies present type I profiles
- Small fraction of type III profiles