Effects of Secular Evolution on the Star Formation History of Galaxies

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AMIGA: Analysis of the Interstellar Medium of Isolated GAlaxies

- Catalogue of Isolated Galaxies (CIG) - 1051 (Karachentseva 1973)
  - Very restrictive selection criteria - No major tidal interaction within the last ~3 Gyr
  - Better than field (pairs, loose groups)
  - Revision and quantification of the isolation – we continue cleaning the sample

- Goal: to quantify the properties of the AMIGA sample
  - To study the properties at all wavelength
  - To minimize non-secular evolution effects

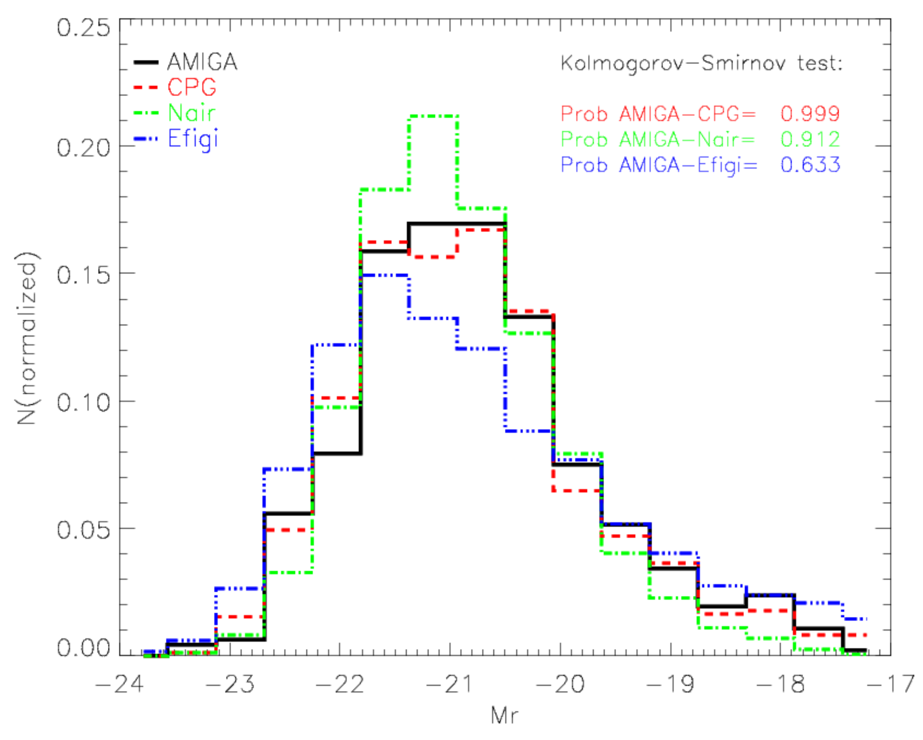
- Study of Star Formation History of isolated galaxies:
  - Optical colors of the AMIGA sample
    (Fernández Lorenzo et al. 2012, A&A, 540, 47)
  - Stellar mass-size relation for isolated galaxies

Optical colors of the AMIGA sample

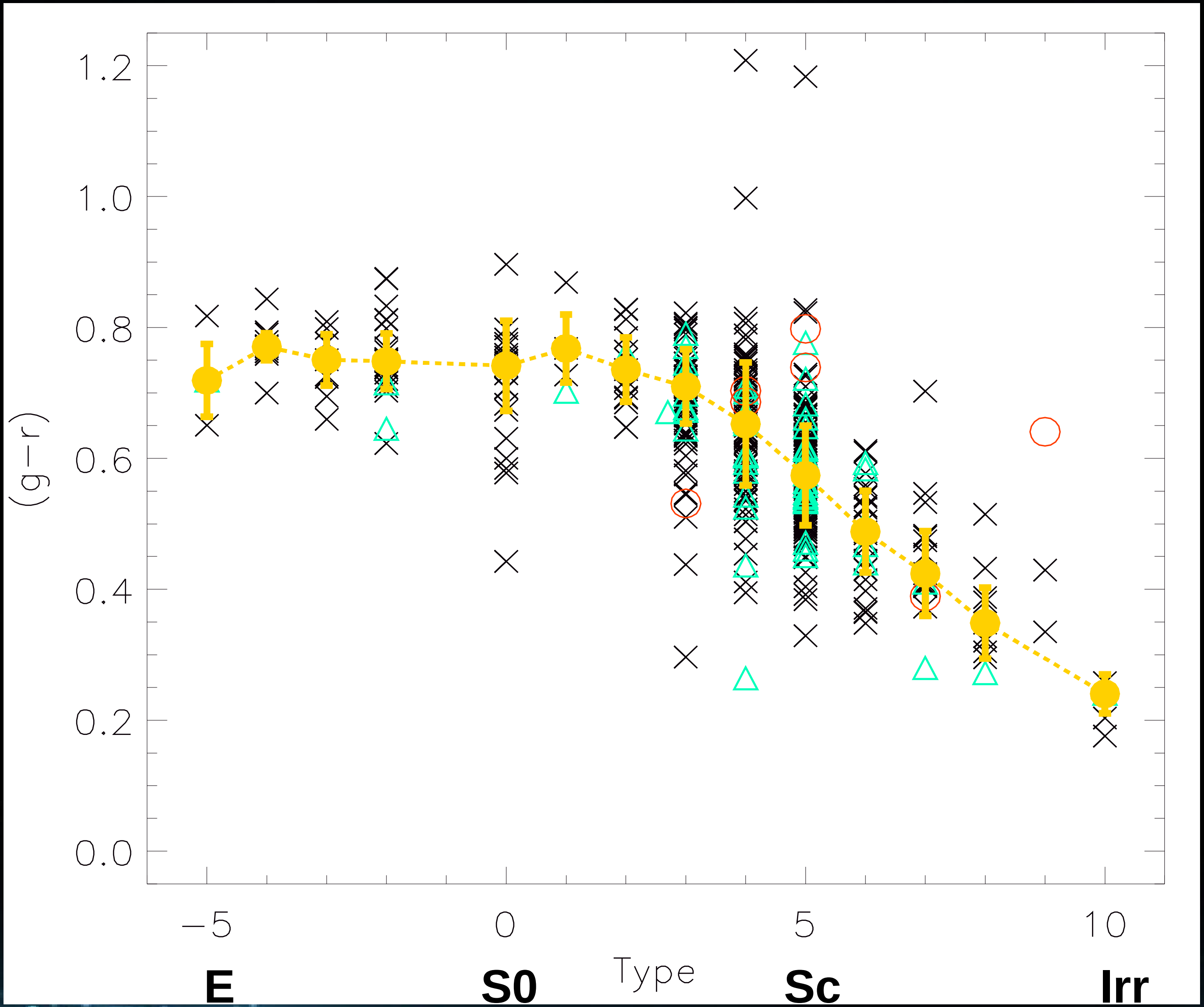
- SDSS database – Model magnitudes in g and r-bands (DR8~800)

- Sample selection:
  - Isolation criteria of Verley et al. (2007)
  - Completeness condition (MagB<15.3)
  - 466 AMIGA galaxies

- Three samples of comparison:
  - Catalogue of isolated Pairs of Galaxies (CPG; Karachetsev 1972)
  - Nair & Abraham (2010)
  - EFIGI catalogue (Baillard et al. 2011)



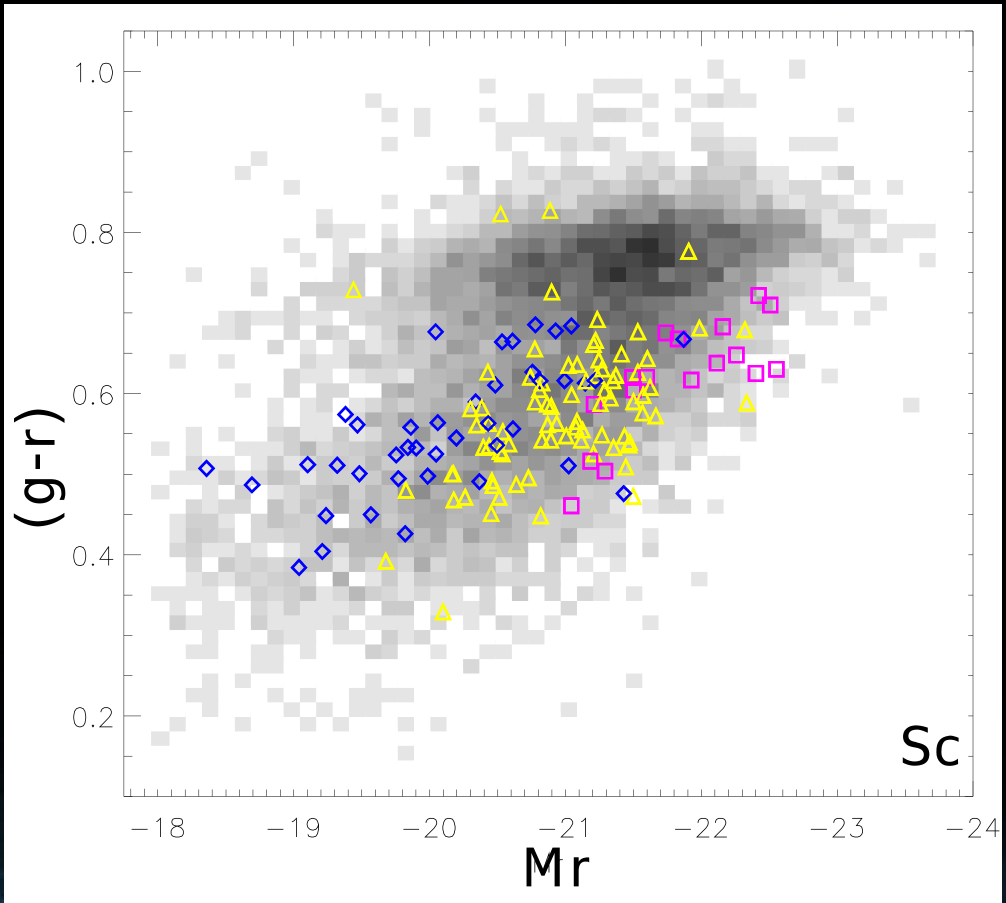
Optical colors of the AMIGA sample

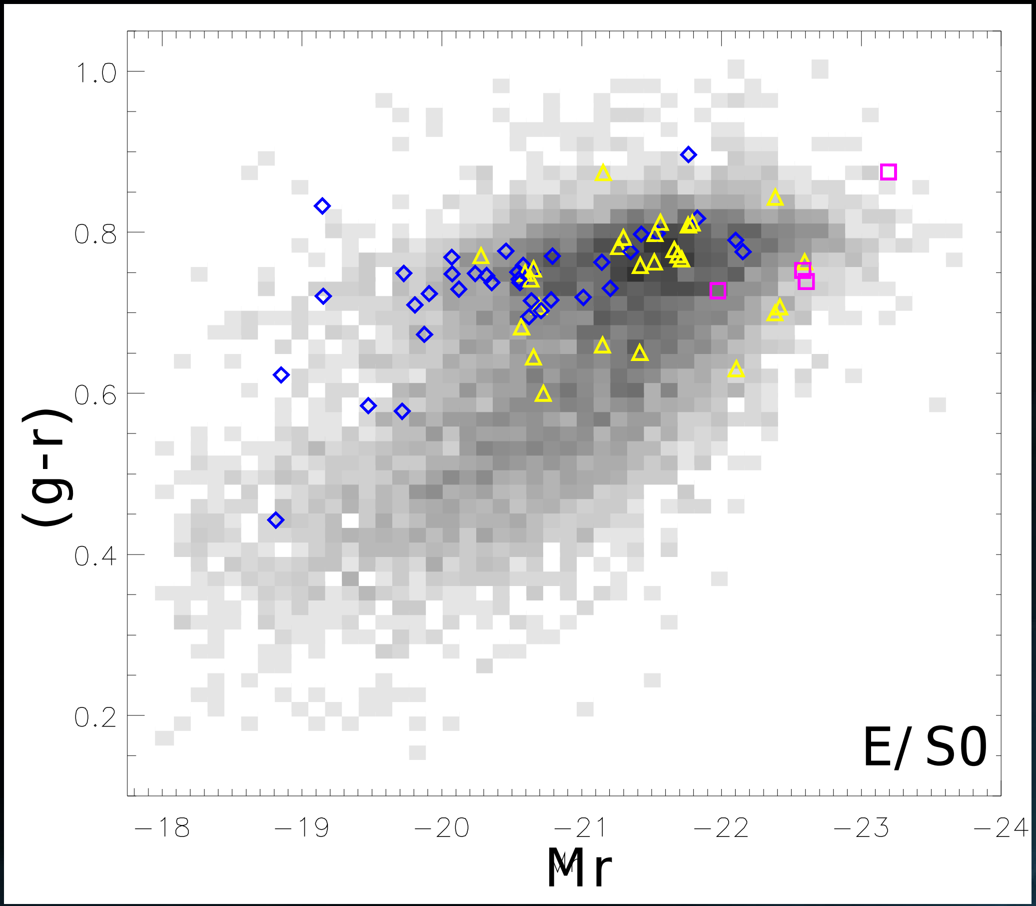


Optical colors of the AMIGA sample

- Major source of color dispersion ⇒ color-luminosity trend
- Bias of color versus recession velocity

AMIGA sample: $0.005<z<0.02$ $0.02<z<0.04$ $z>0.04$





Optical colors of the AMIGA sample

- The spiral close pairs are bluer than AMIGA (but within the errors)
- Absolute median deviations are greater for both wide and close pairs
- Colors of AMIGA show a Gaussian distribution – nurture free evolution

Type	T	AMIGA	NAIR	EFIGI	CPG (WID)	CPG (CLO)
E	-5	0.72±0.06	0.78±0.03	0.78±0.03	0.79±0.03	0.76±0.03
E	-4	0.77±0.02	–	0.78±0.02	0.80±0.08	0.79±0.04
E/S0	-3	0.75±0.04	0.76±0.05	0.77±0.04	0.79±0.06	0.77±0.07
S0	-2	0.75±0.04	0.76±0.04	0.76±0.04	0.78±0.06	0.77±0.06
S0	-1	–	–	0.78±0.06	0.72±0.05	0.73±0.09
S0/a	0	0.74±0.07	–	0.76±0.07	0.77±0.05	0.78±0.04
Sa	1	0.77±0.05	0.71±0.06	0.73±0.05	0.72±0.11	0.71±0.09
Sab	2	0.74±0.05	0.69±0.07	0.72±0.07	0.71±0.10	0.67±0.15
Sb	3	0.71±0.06	0.67±0.08	0.71±0.08	0.71±0.13	0.69±0.12
Sbc	4	0.65±0.09	0.61±0.08	0.66±0.07	0.63±0.12	0.59±0.14
Sc	5	0.57±0.08	0.56±0.08	0.62±0.09	0.69±0.12	0.51±0.15
Scd	6	0.49±0.06	0.46±0.07	0.58±0.09	0.55±0.11	0.51±0.17
Sd	7	0.42±0.06	0.42±0.06	0.47±0.08	0.34±0.17	0.43±0.10
Sdm	8	0.35±0.05	0.41±0.07	0.44±0.12	0.48±0.07	0.30±0.12
Sm	9	–	0.36±0.09	0.40±0.16	–	0.56±0.13
Im	10	0.24±0.03	0.33±0.10	0.29±0.09	–	0.29±0.12

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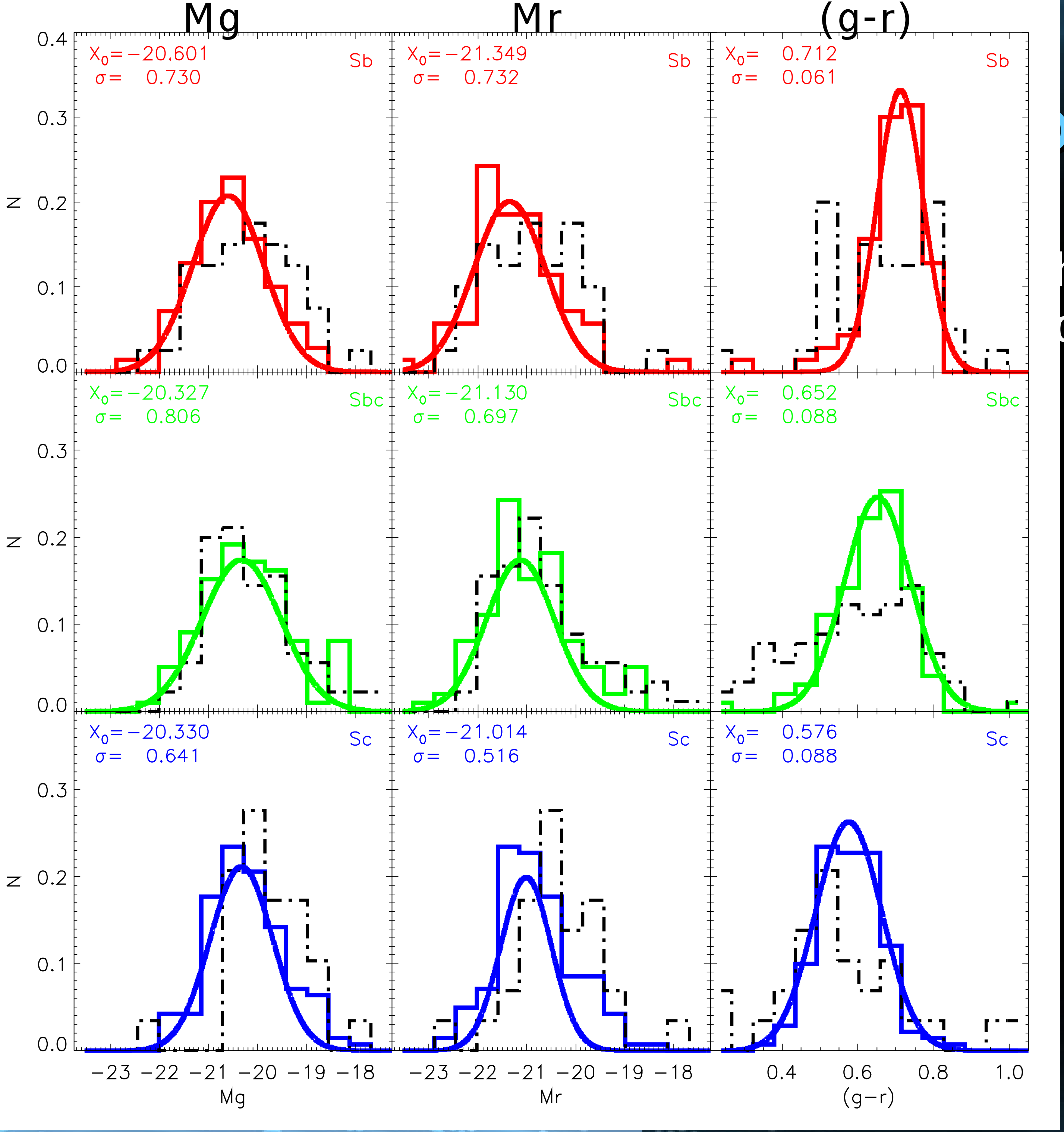
- Absolu … d close pairs
- Colors … free evolut



Optical colors of the AMIGA sample

Conclusion:

The redder colors of AMIGA spirals and lower color dispersions compared with close pairs, is likely due to a more passive star formation in very isolated galaxies.

(Fernández Lorenzo et al. 2012, A&A, 540, 47)

On-going work:

Using directly the images to measure the colors, due to the bias introduced by SDSS/DR8 automated measures

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, Maltby et al. 2010)
  - z~1 cluster galaxies similar to z=0 (Cimatti et al. 2008)

Are our isolated galaxies smaller than other galaxies?

Stellar mass-size relation

- 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 et al. 2007)

- Sample selection:
  - Galaxies that follow the isolation criteria of Verley et al. (2007)
  - Completeness criteria: mag B<15.3 (~mag r<14.5)
  - 466 galaxies follow these conditions

Stellar mass-size relation

- Half-light radius given by SExtractor as size
- Comparison with the local relations of Shen et al. (2003)

- Good agreement with the effective radius obtained by fitting Sérsic function with Galfit for a subsample of ~80 galaxies in DR7

Stellar mass-size relation

Fernández Lorenzo et al. (in preparation)

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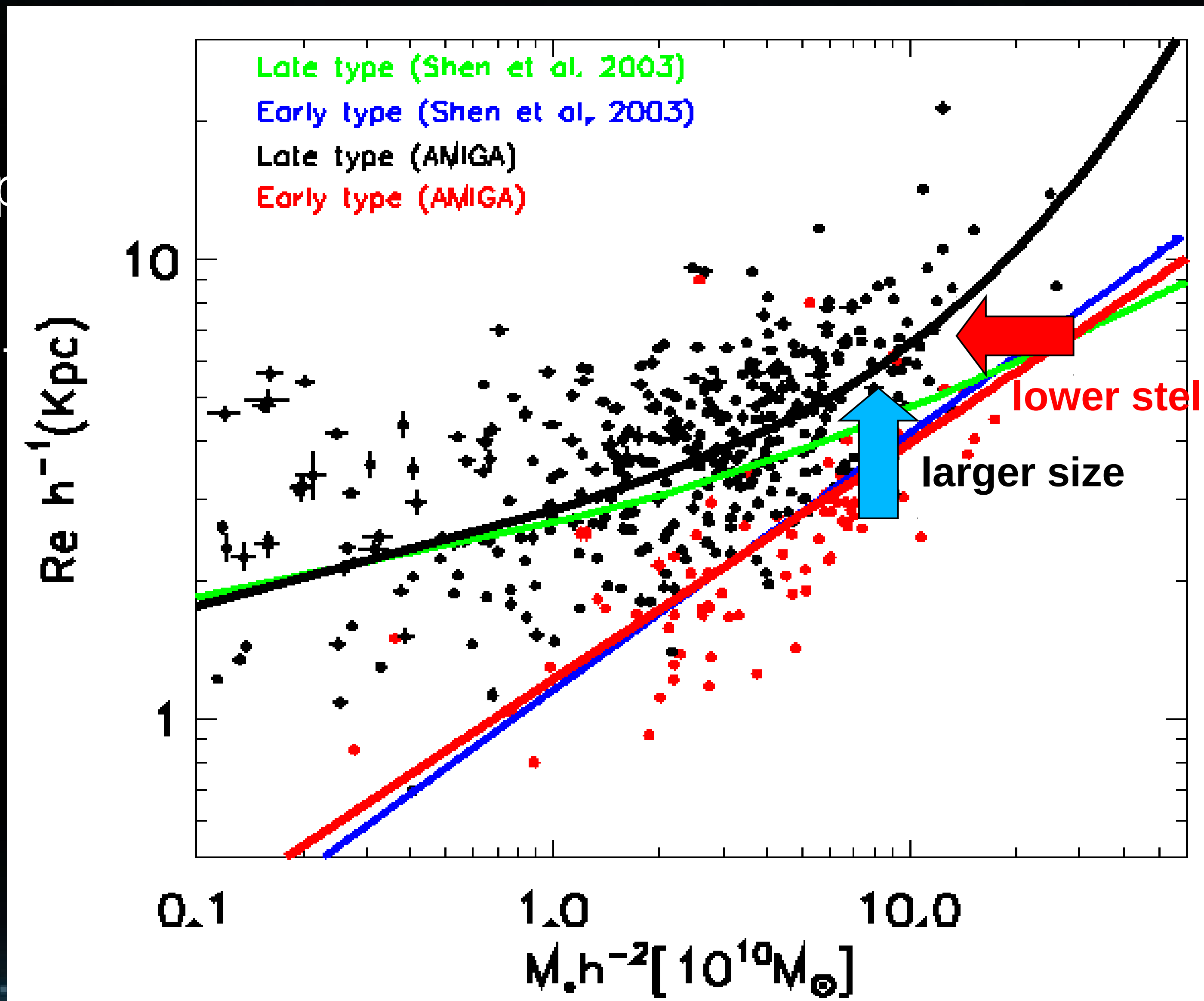
- Comp 3)

- Good tting

Sérsic s in DR7



Stellar mass-size relation

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- Lower stellar mass - no external processes have increased their star formation during most of their life?
- Larger sizes - have they accreted more small satellite galaxies than other local objects?

Work in progress