Does the environment matter?

Morphological analysis of the FORNAX cluster

P. Dimauro

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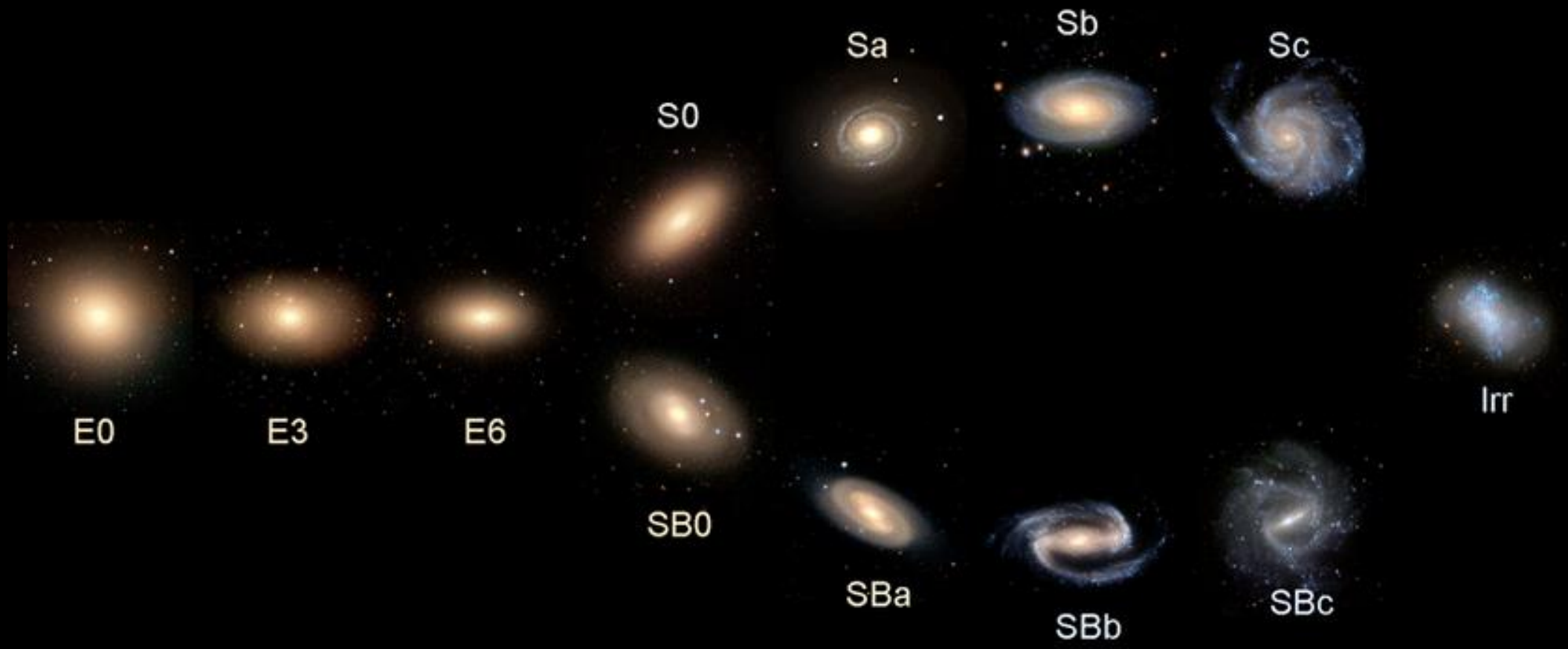
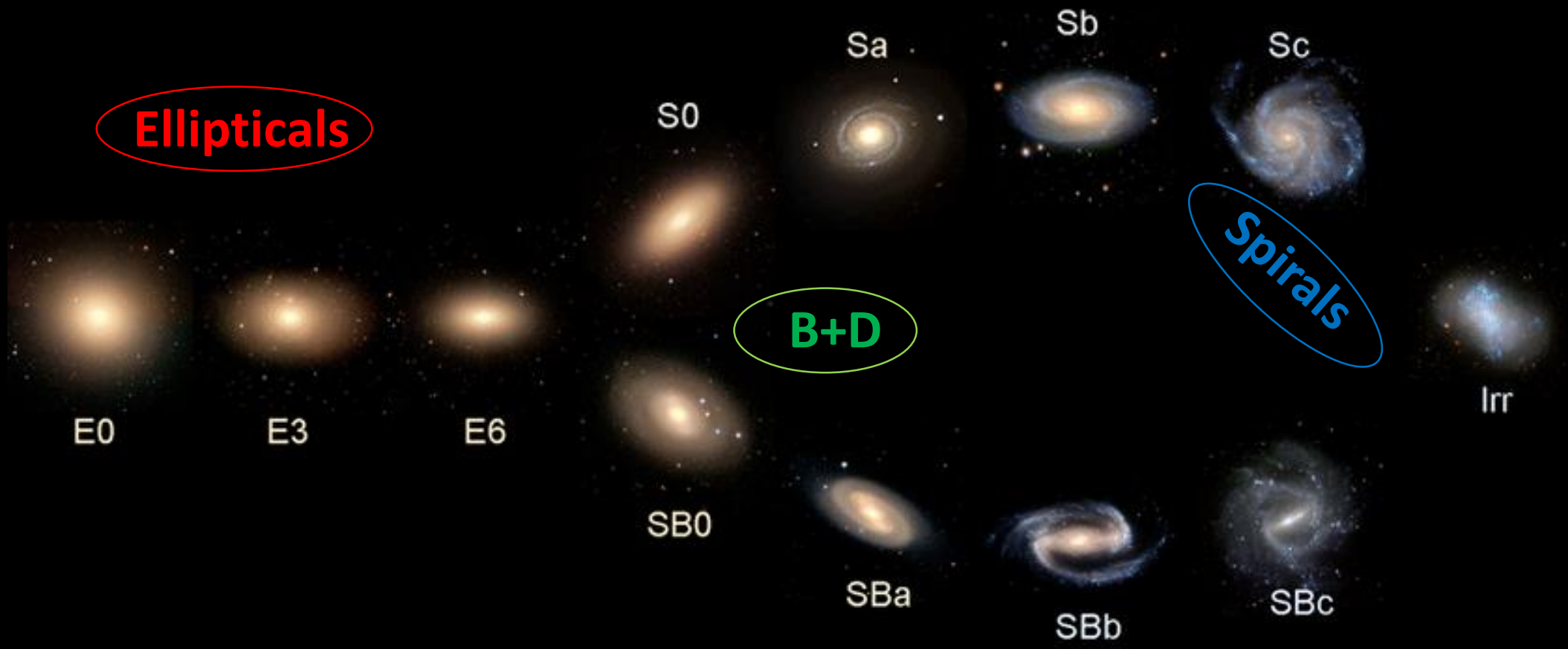
G. Lucatelli, A.Smith Castelli, A. Reis Lopes, L. Sodré

16° S-PLUS Meeting – December 2021

Hubble Sequence



Hubble Sequence



Why galaxies stop forming stars?
quenching mechanisms

The main source to produce stars is the gas content

Preventing cooling

Halo mass quenching

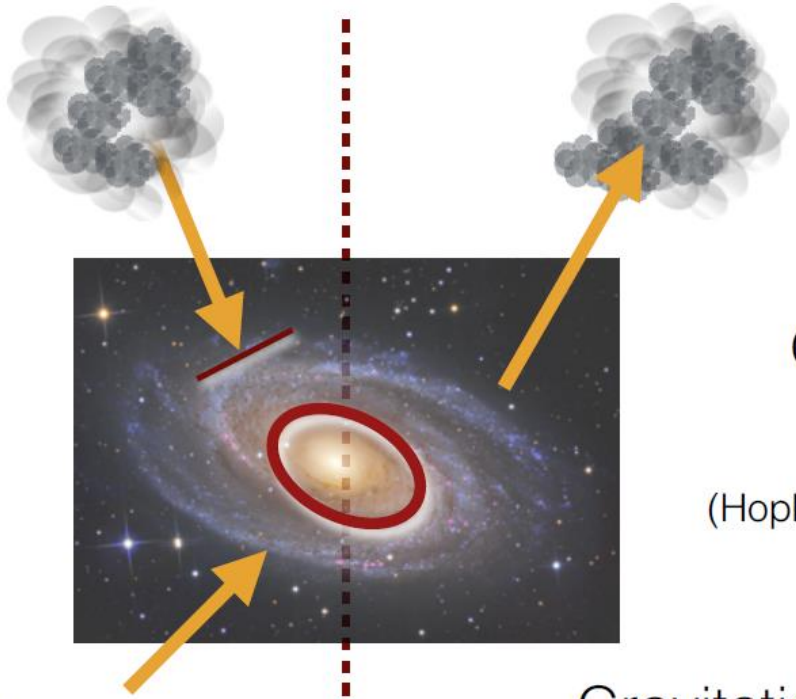
stops the accretion of new cold gas

(Birboim & Dekel 2003, Peng 2015)

Morphological quenching

The accretion of a central density stabilizes the gas in the disk

(Martig 2008)



Gas removal

Outflows of gas

AGN, supernove

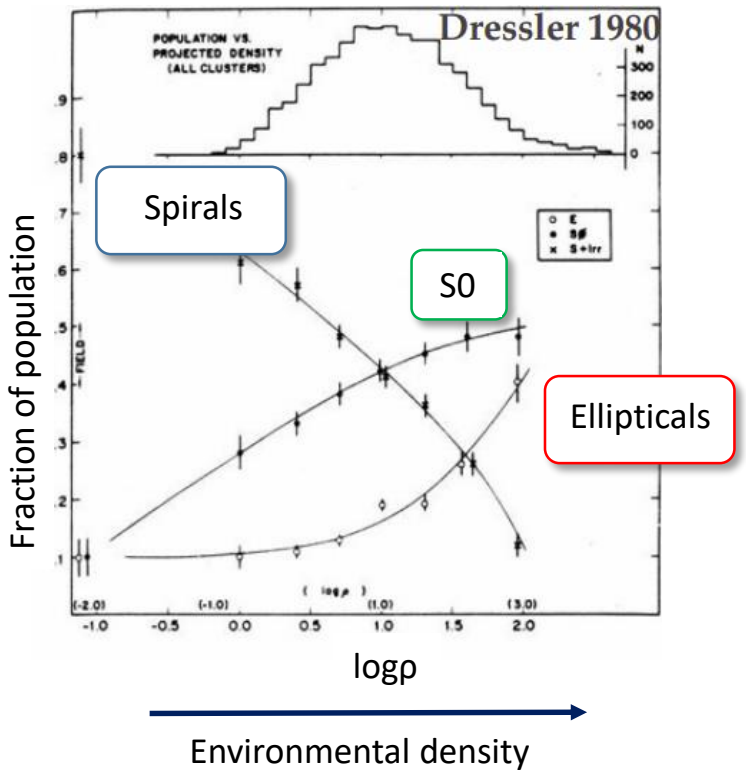
(Hopkins 2014, Cattaneo 2009)

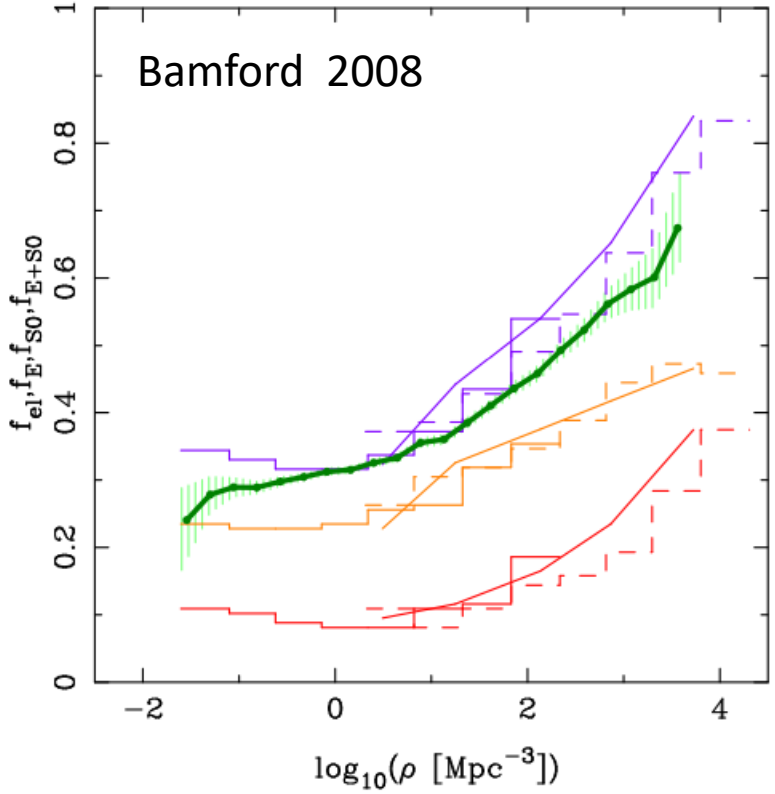
Gravitational interactions

(ram pressure stripping, tidal interaction, etc)

(Gunn & Gott 1972, Nulsen 1982, Moore et al. 1996)

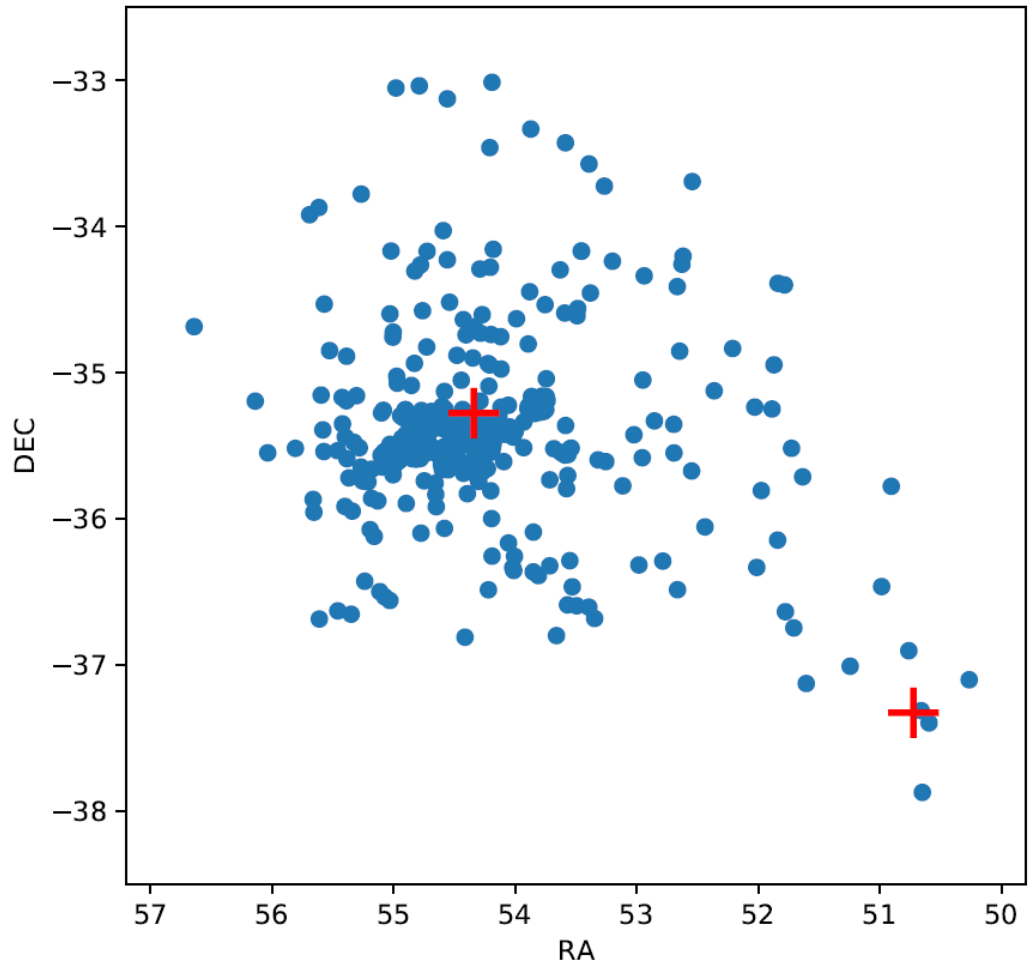
Morphology & Environment





Does the environment affect **morphology** of galaxies?

FORNAX cluster



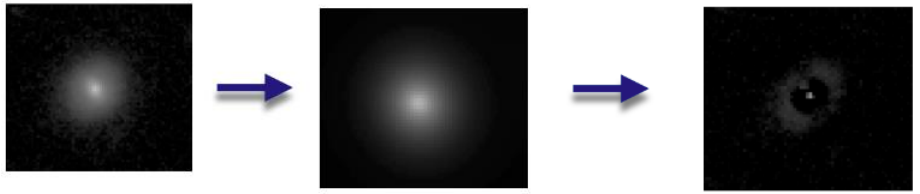
Catalog: match from literature catalogs

[Ferguson et al, 1989 Jordan et al, 2007 Schroeder et al, 2009 Venhola et al, 2017-2018 Maddox et al, 2019]

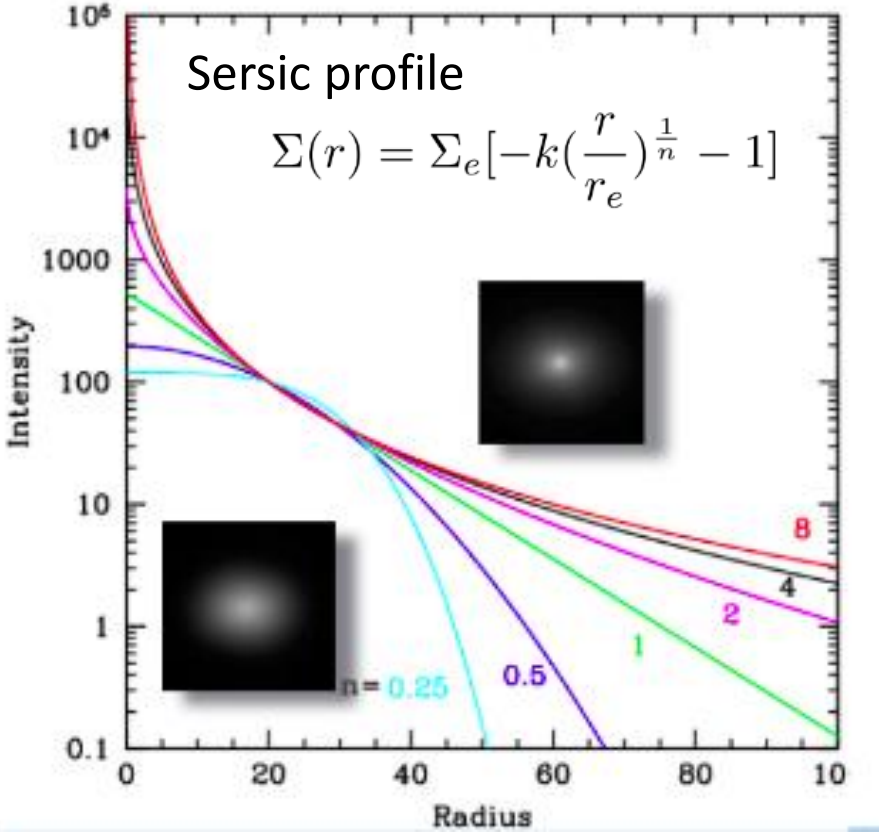
Sample: 500 galaxy members

Morphology with MegaMorph

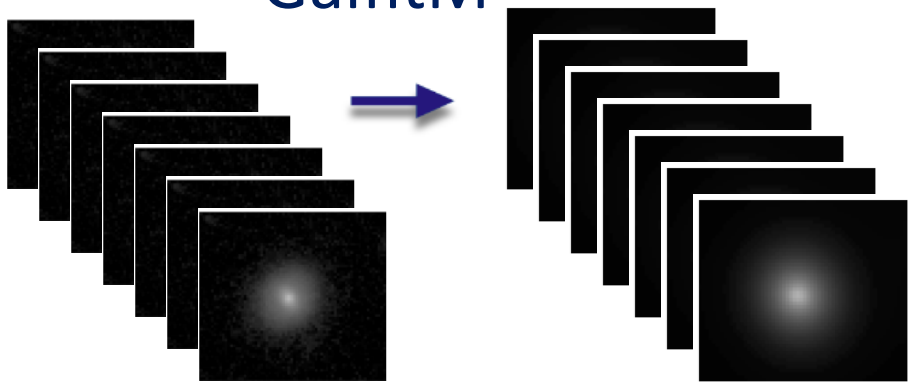
Galfit



data model residual

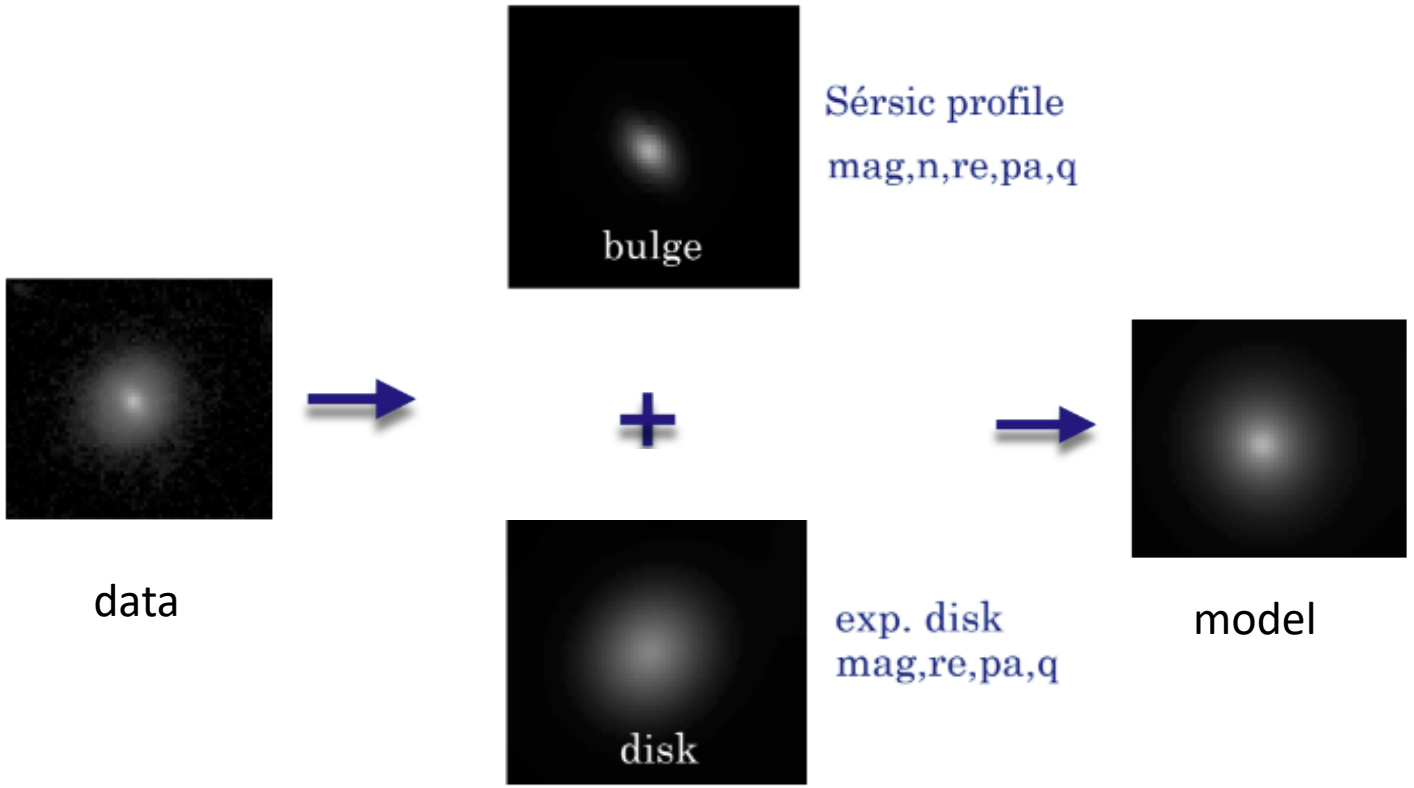


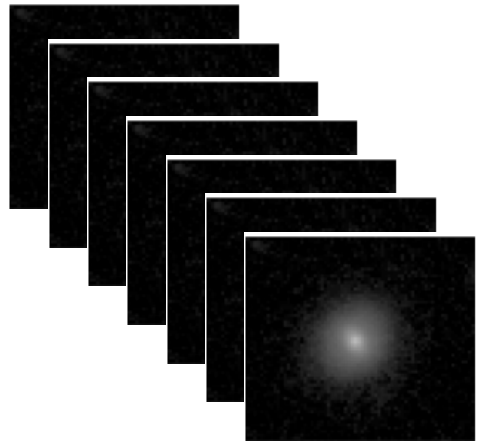
GalfitM



Morphology with MegaMorph

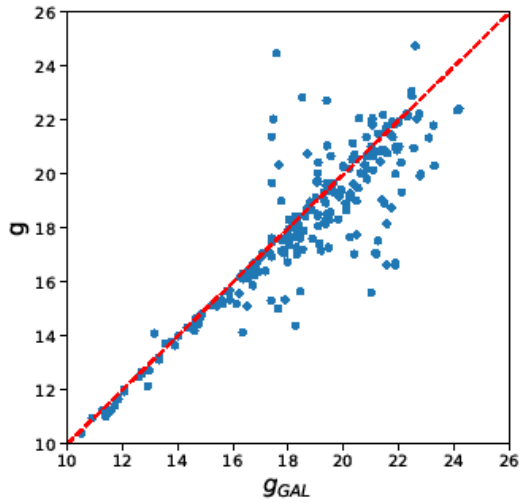
GalfitM – Bulge Disc decomposition

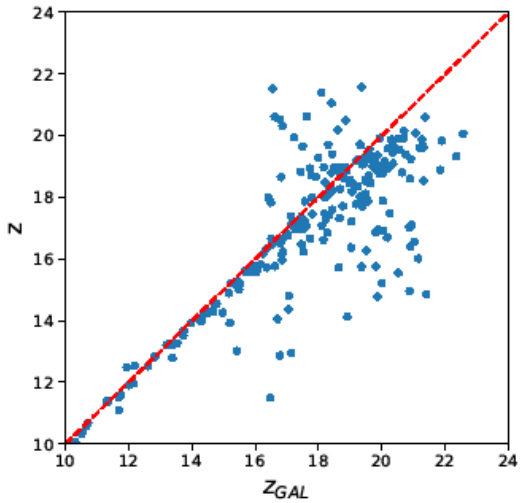


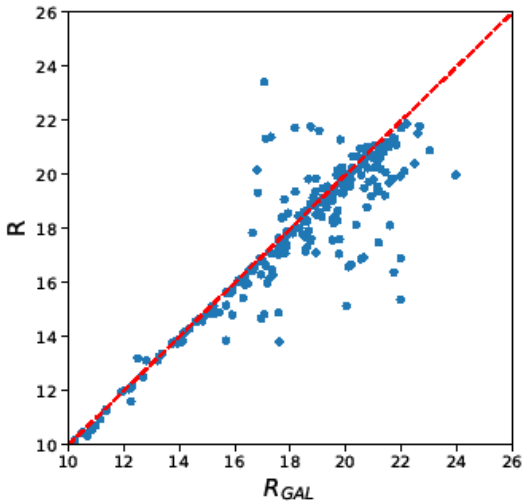


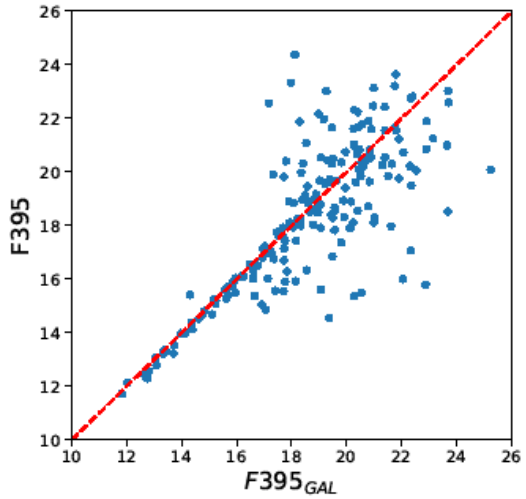
GalfitM

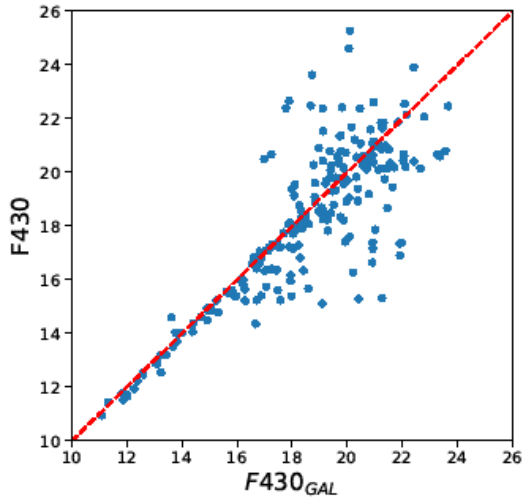
Magnitude comparison with SPLUS iDR3





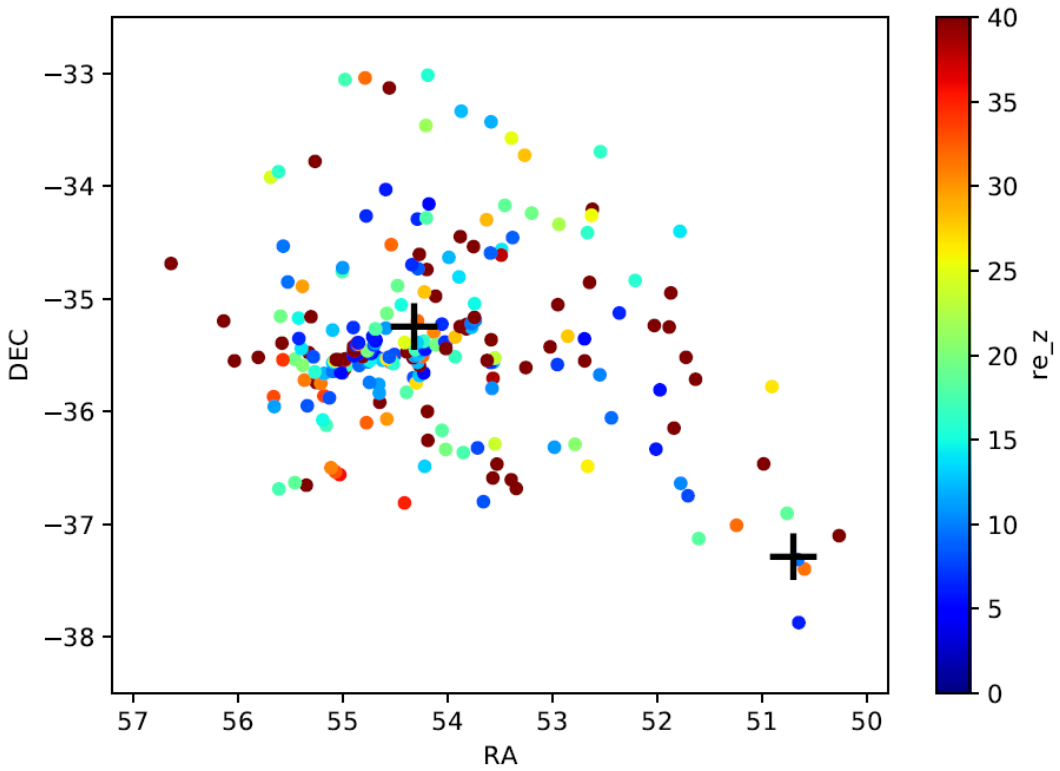


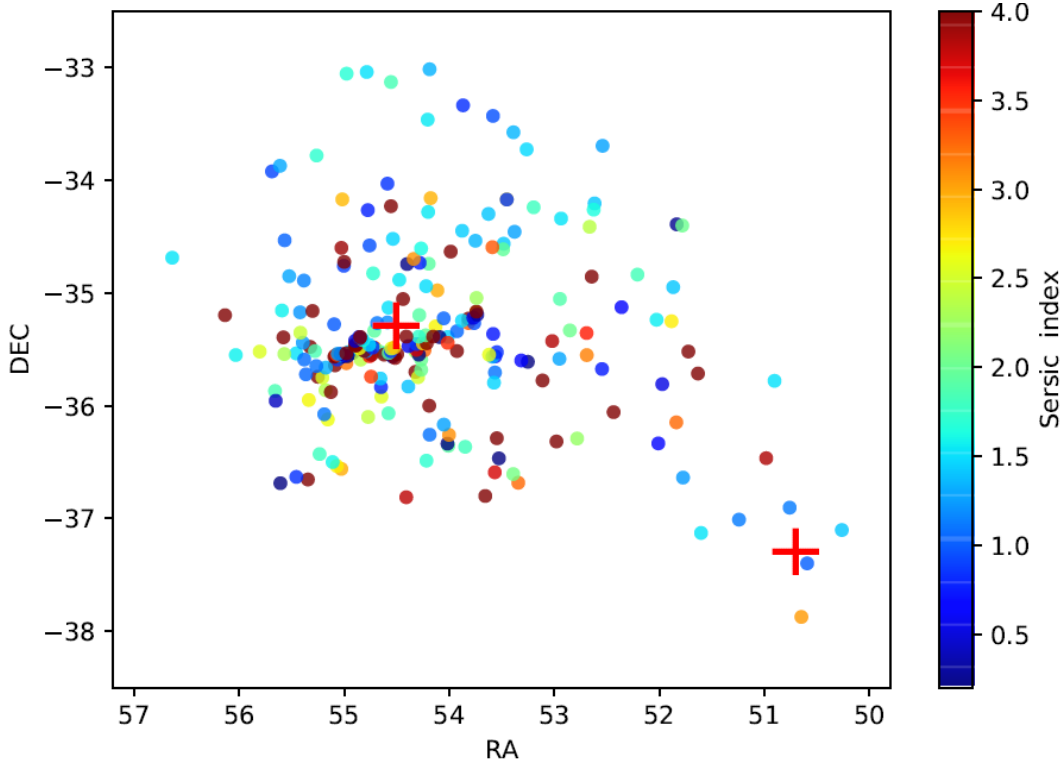




Does the environment affect the morphology?

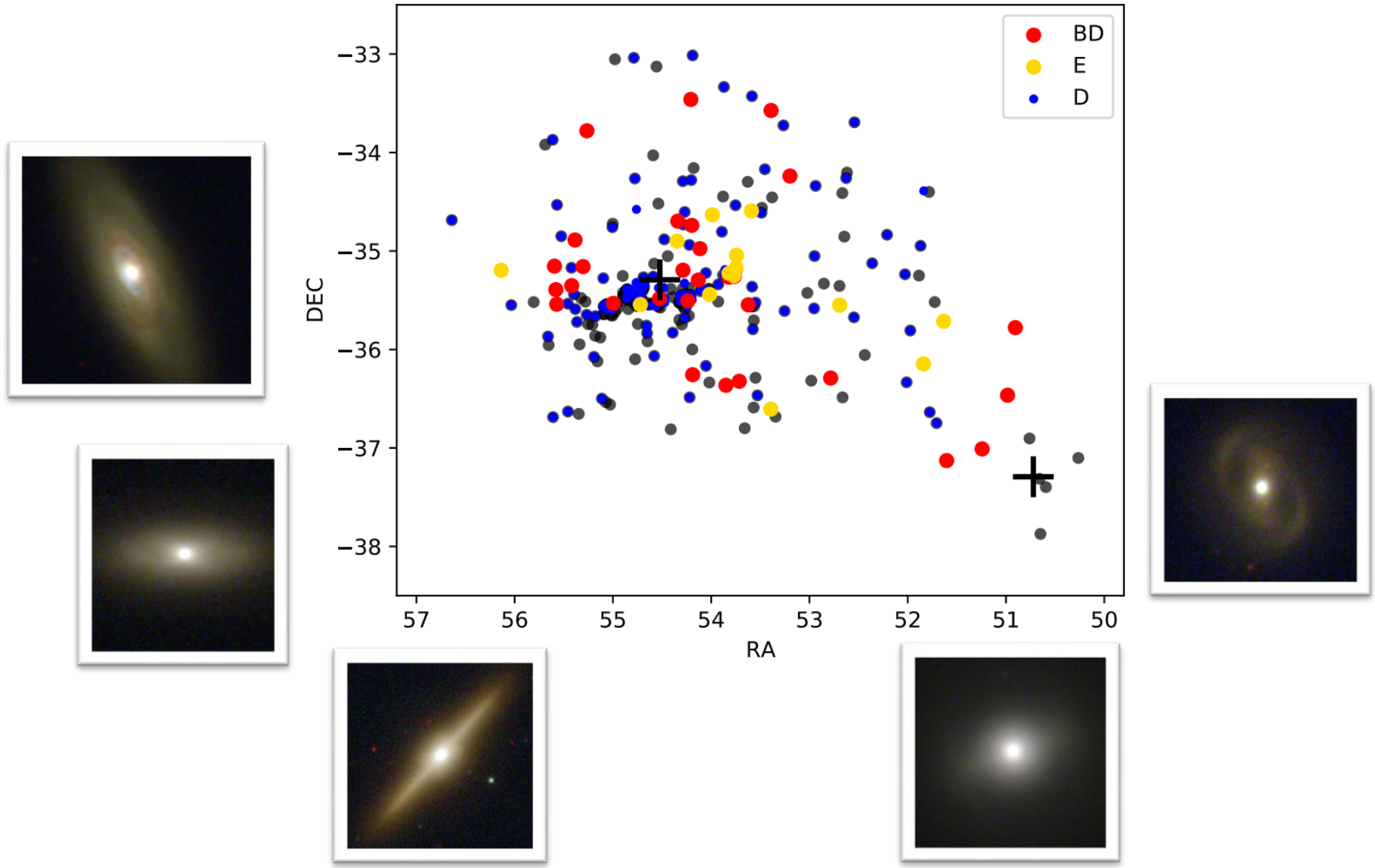
Morphology





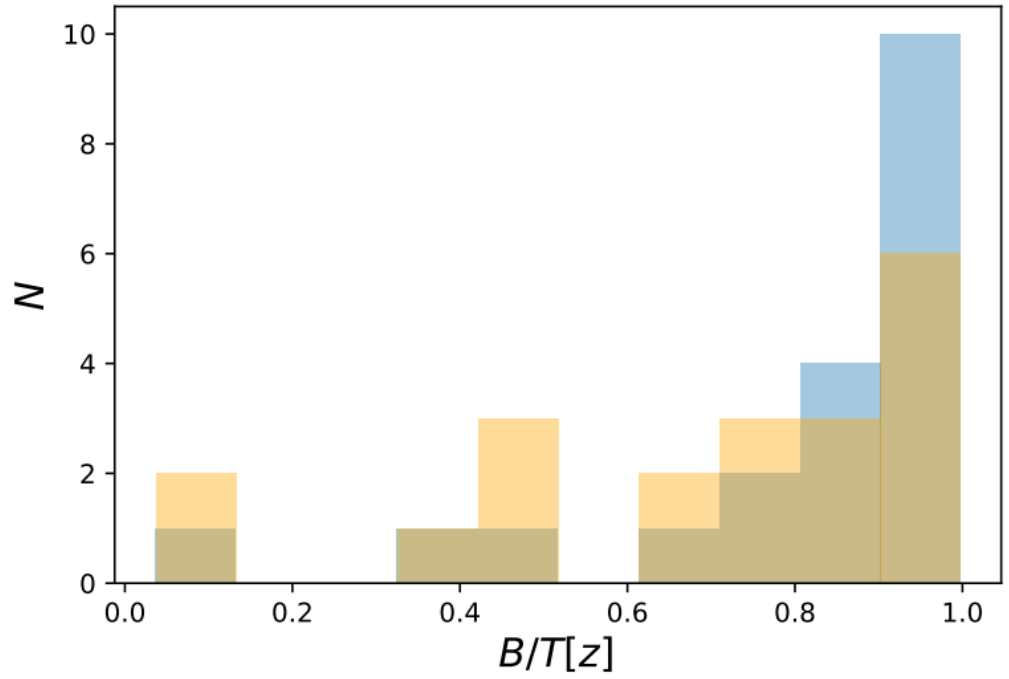
Spheroidal/compact objects are concentrated in the central region

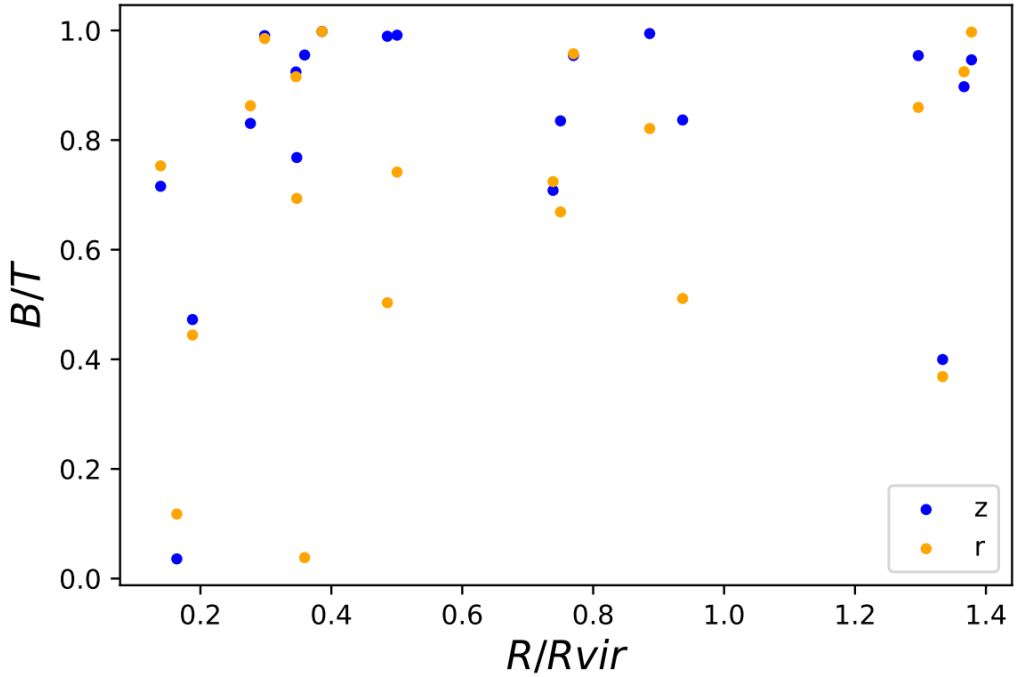
Morphology – where are bulges and disks?



Morphology – where are bulges and disks?

Preliminary results

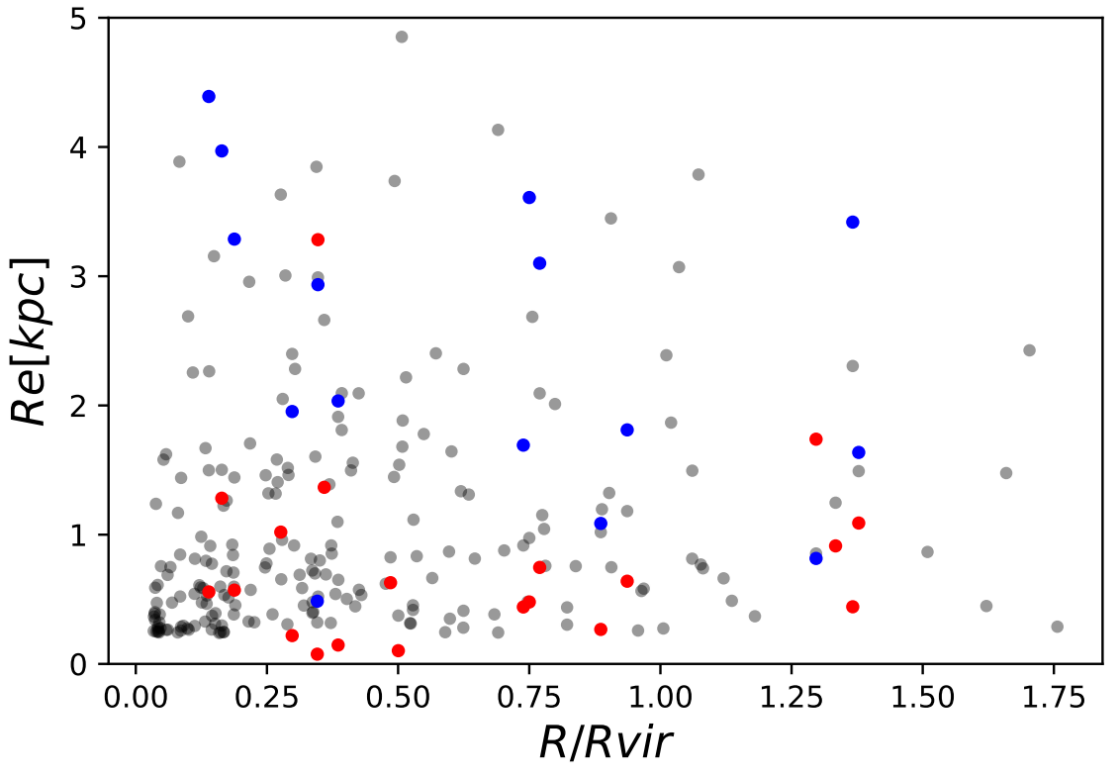




Morphology – where are bulges and disks?

Preliminary results

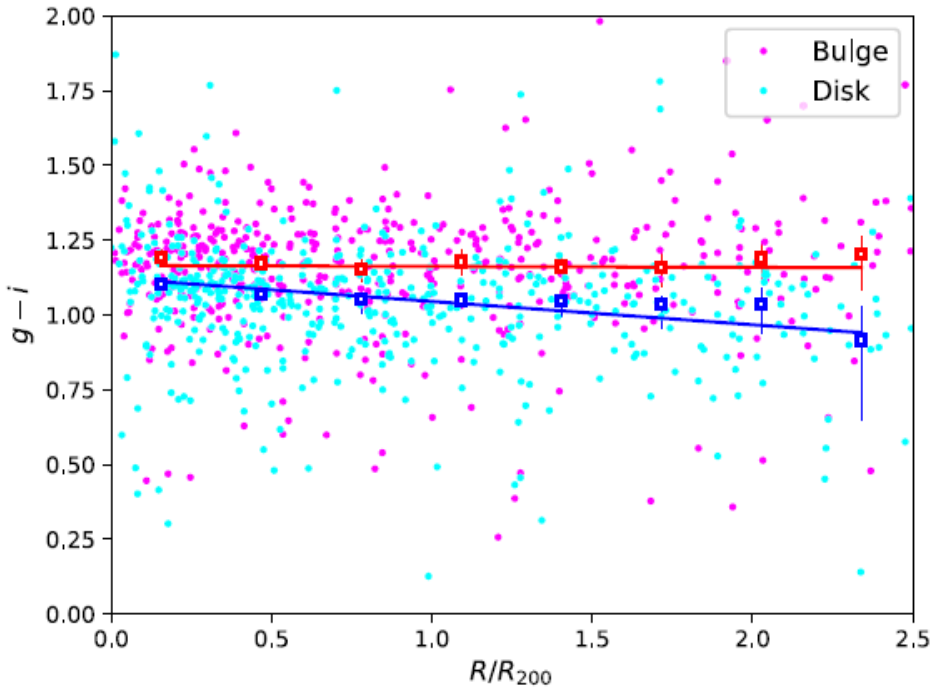
Radial distribution of the half light radii



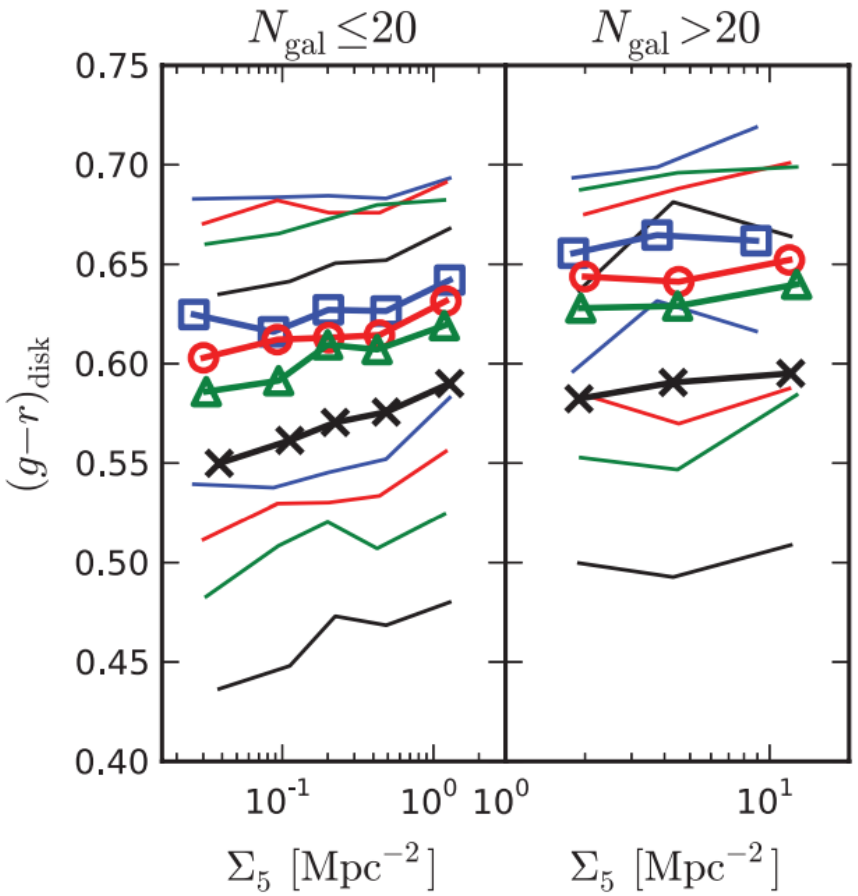
Weak dependences of sizes with the environment

Does the environment affect the star-formation?

Star-Formation & Environment



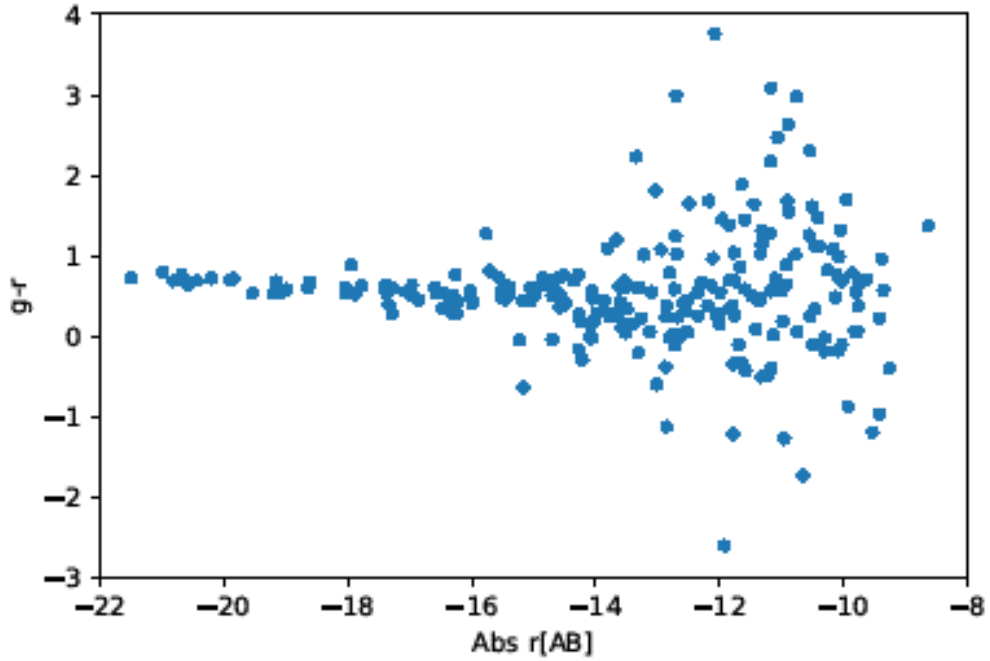
[Barsanti et al, 2021]

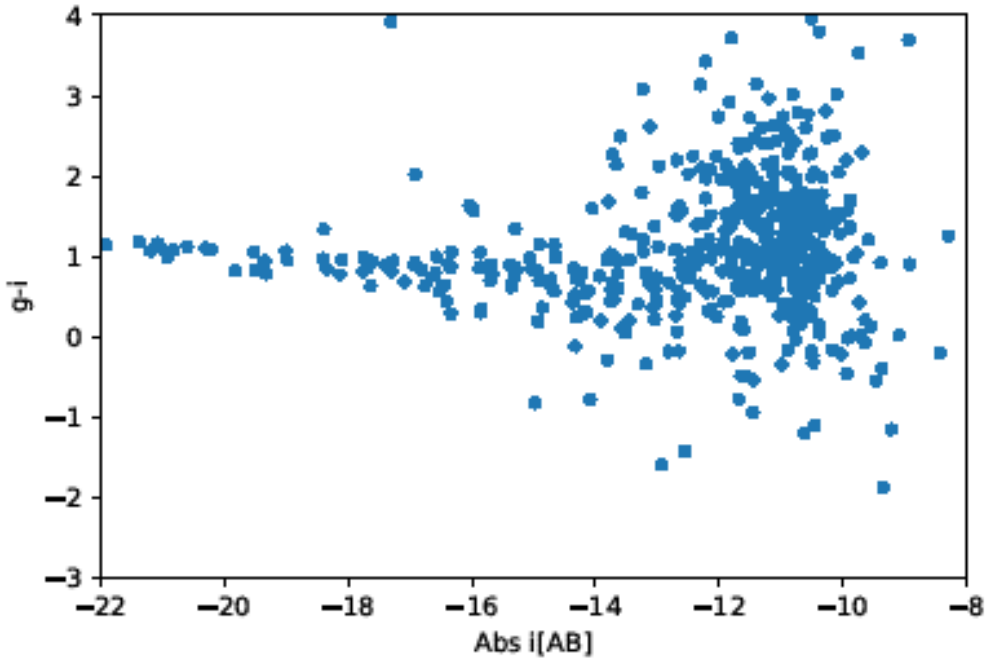


[Lackner & Gunn 2013]

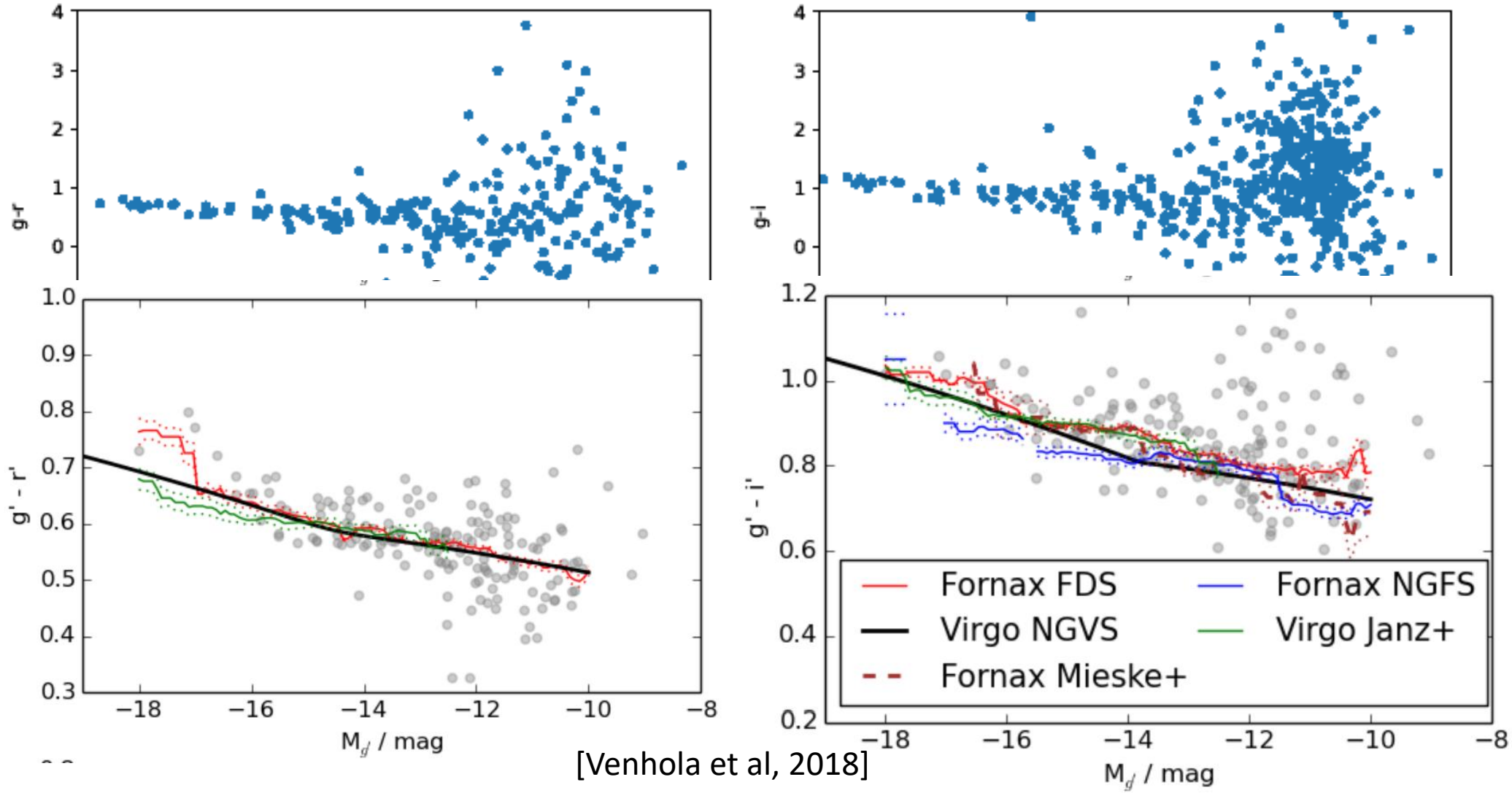
[Hudson et al. 2010, Head et al. 2014, Poggianti et al. 2009, Bamford et al. 2009]

Color-magnitude diagrams



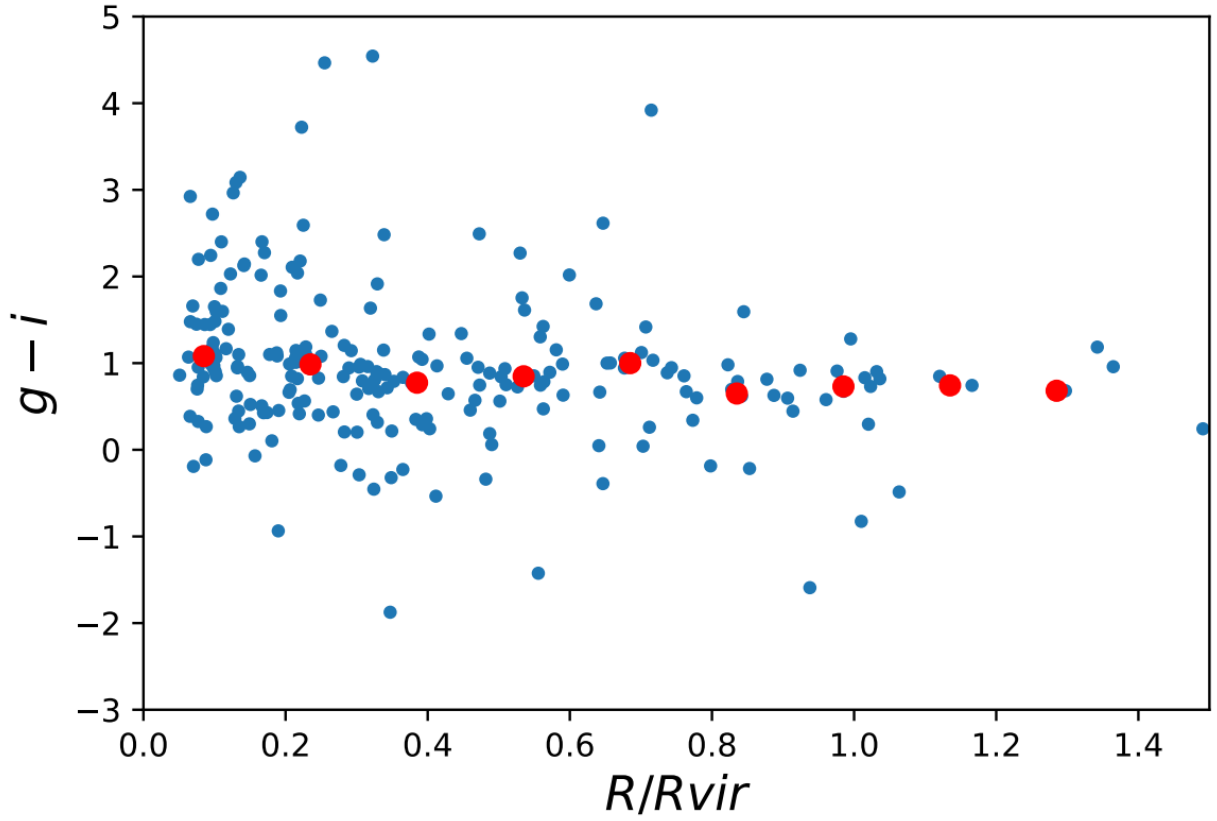


Color-magnitude diagrams

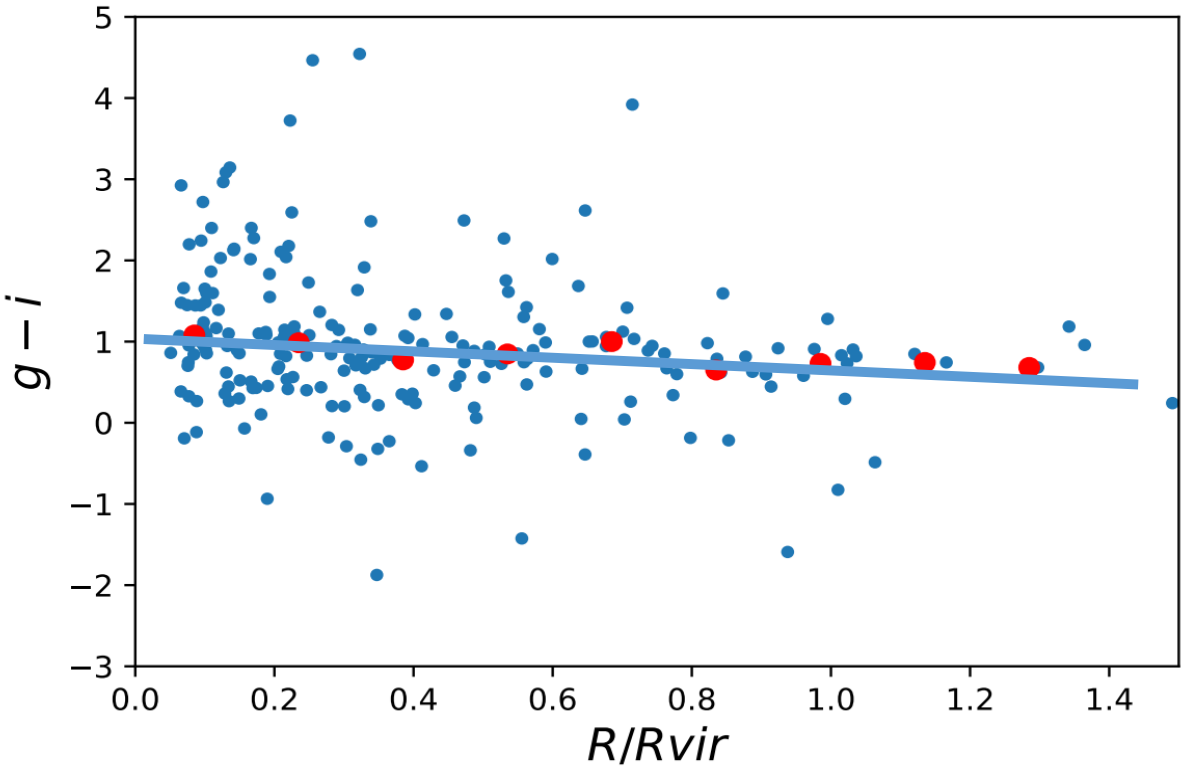


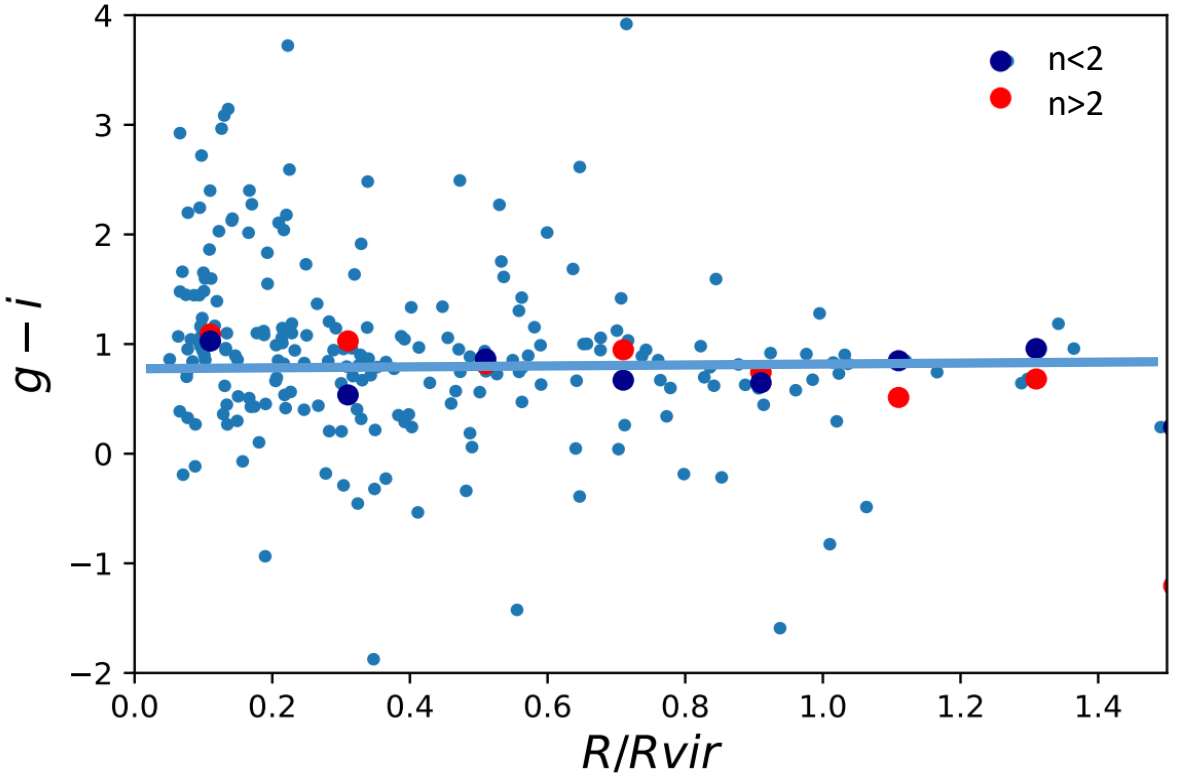
[Venhola et al, 2018]

Radial distribution – colors - morphology

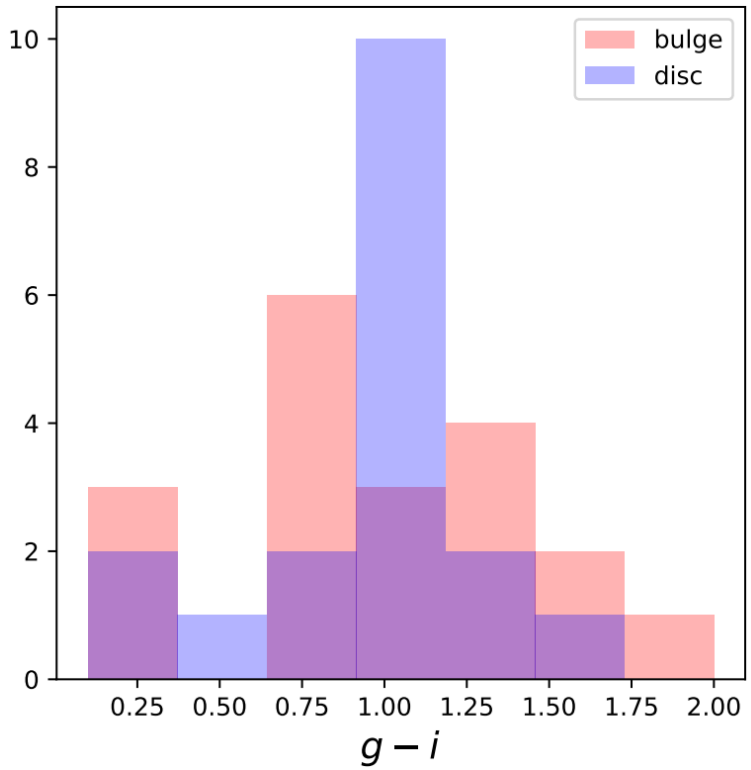


Radial distribution – colors - morphology

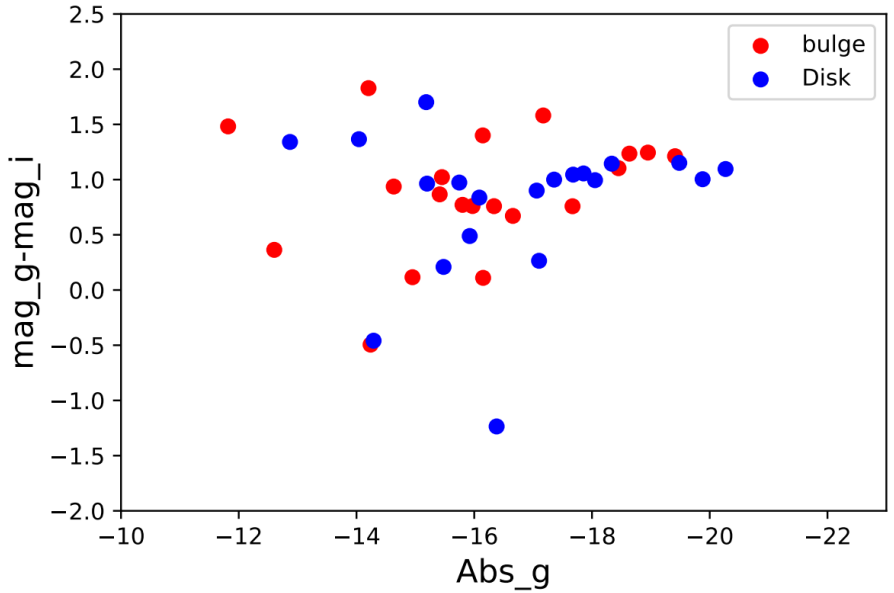


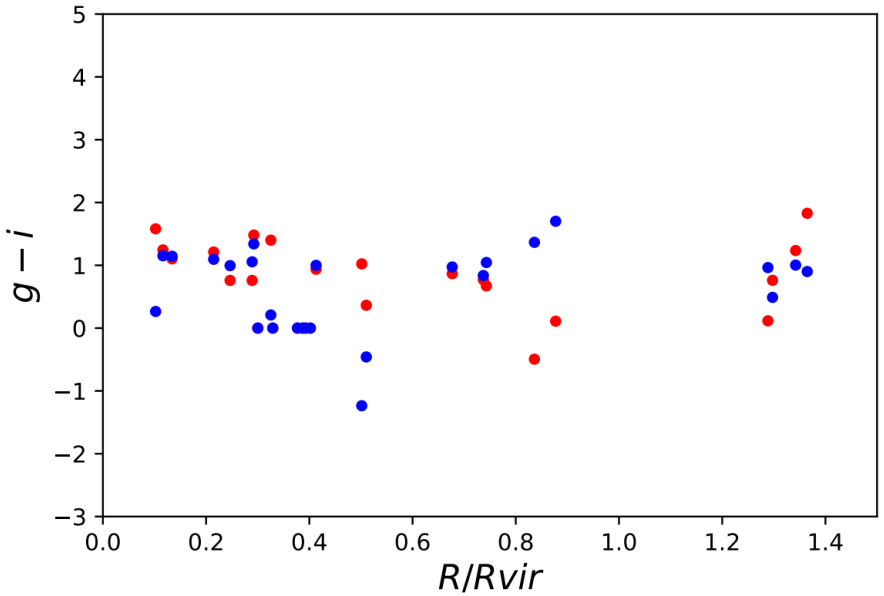


Colors of Bulges and Discs



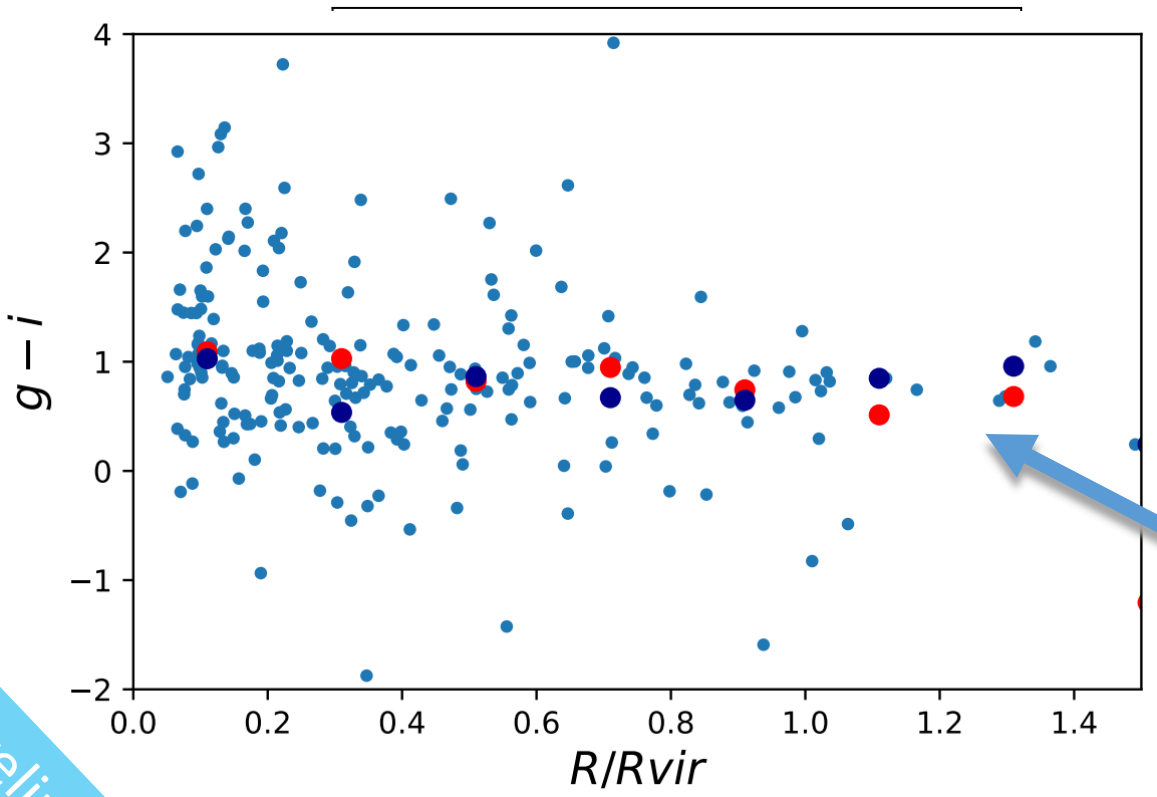
Bulges are redder then disks

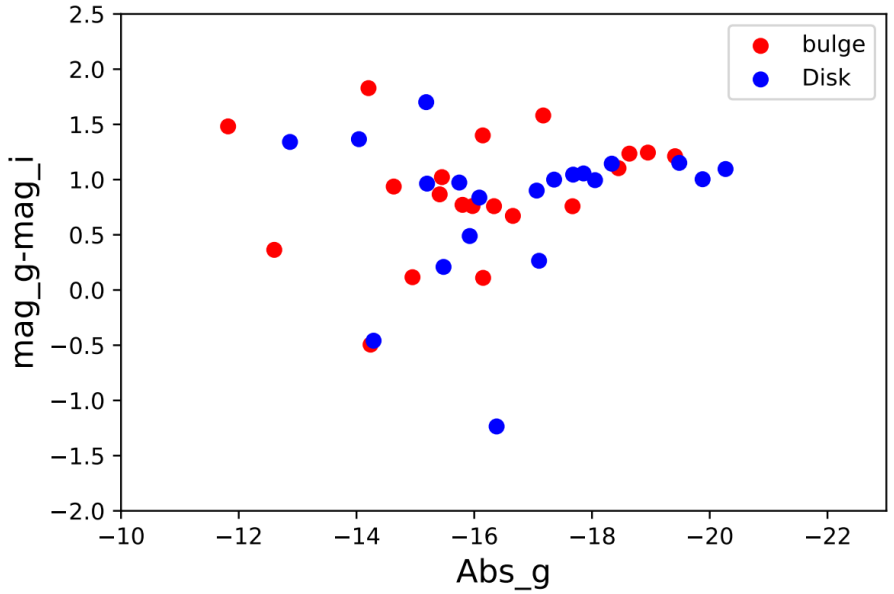


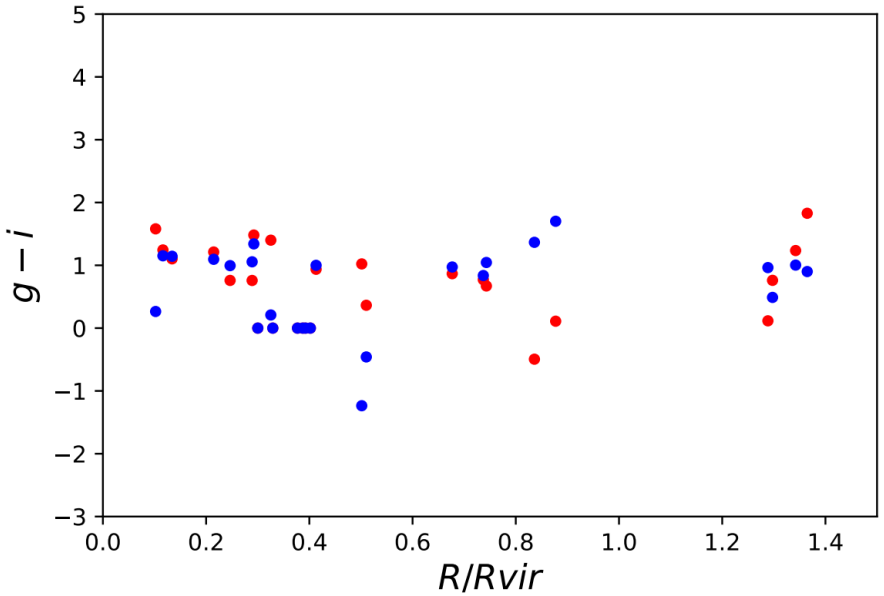


Preliminary results

Colors of Bulges and Discs



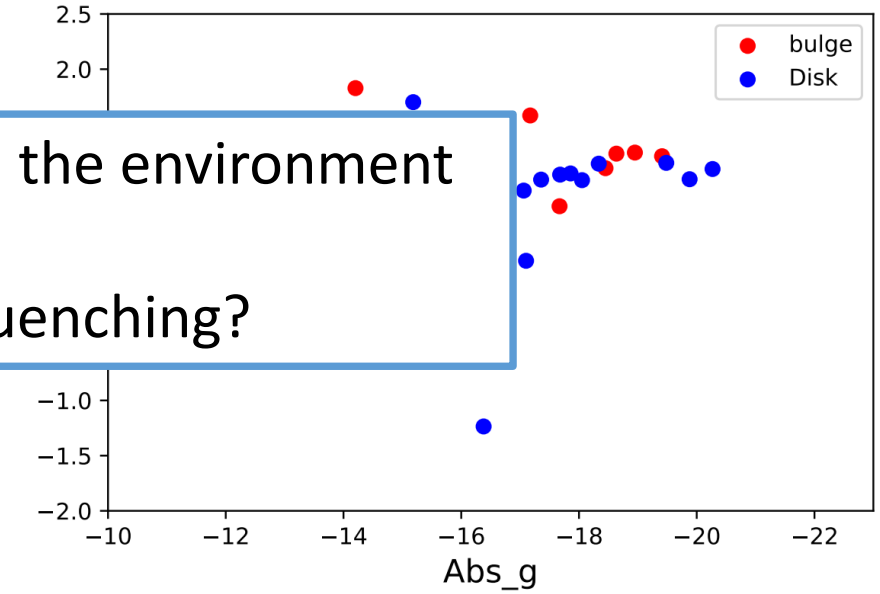




Bulges are redder then disks

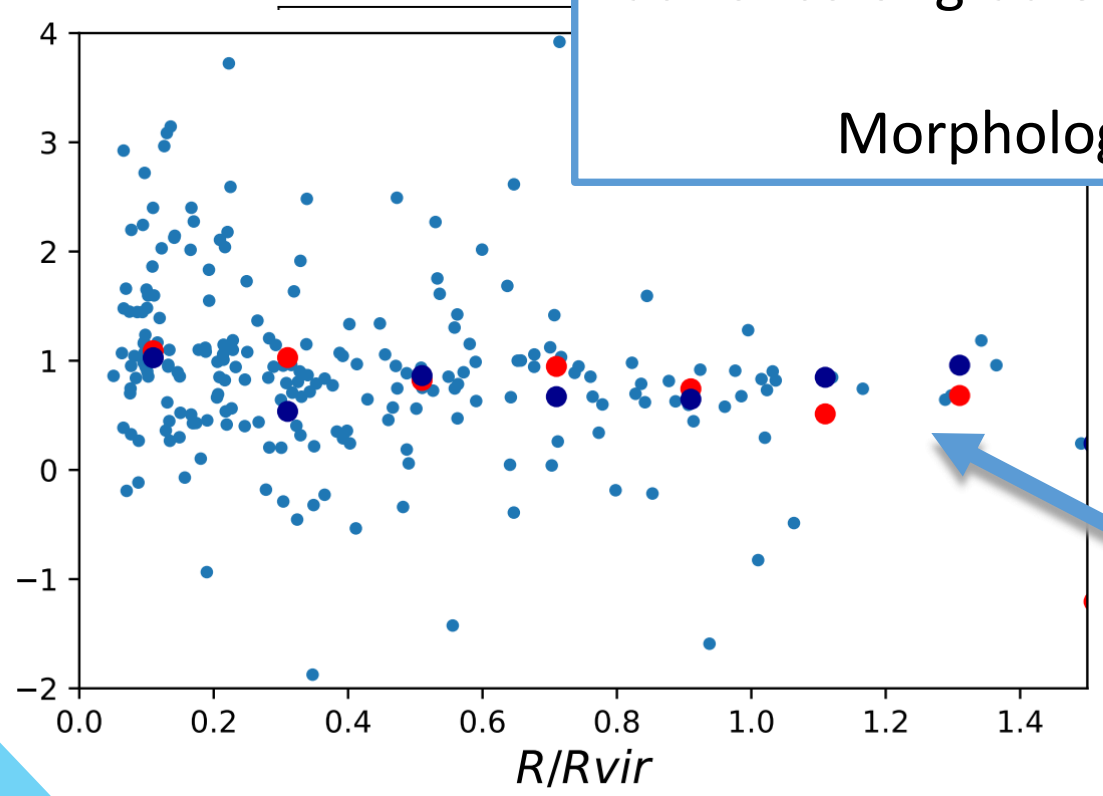
Preliminary results

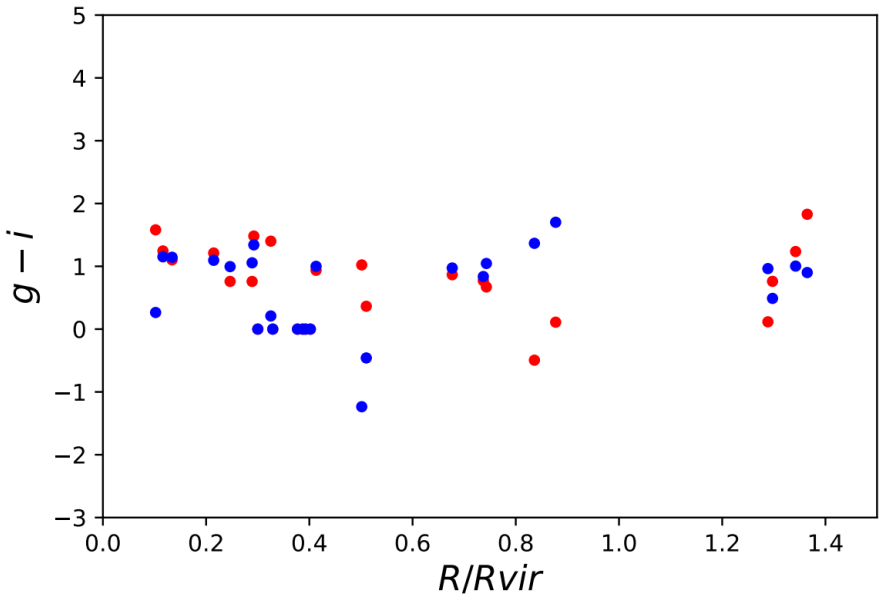
Colors of Bulges and Discs



Lack of color gradient with the environment

Morphological quenching?



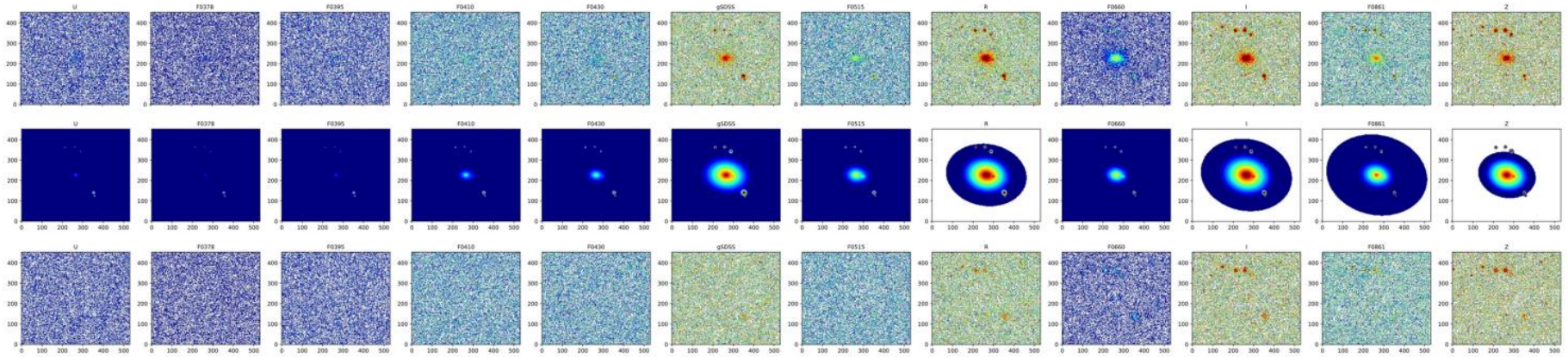


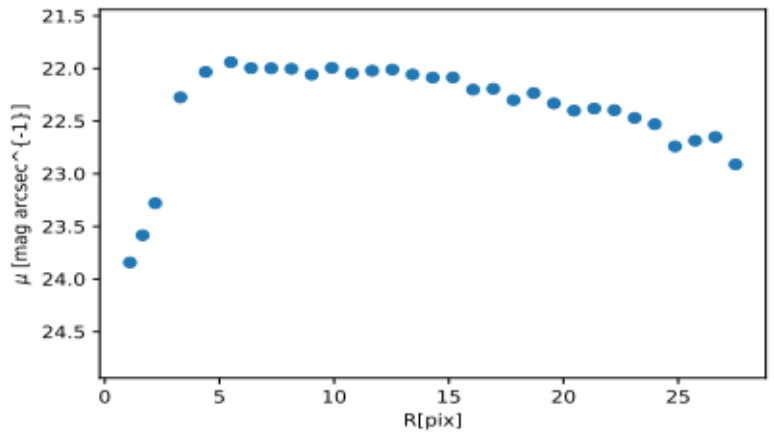
Bulges are redder then disks

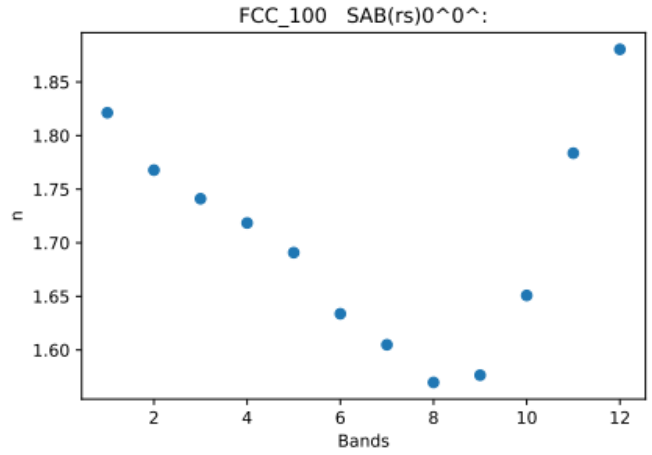
Lackner & Gunn (2013)

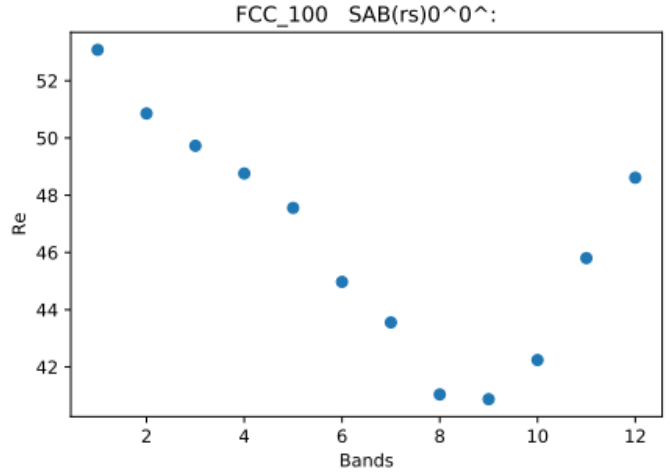
Preliminary results

Multi-wavelength models as classifier

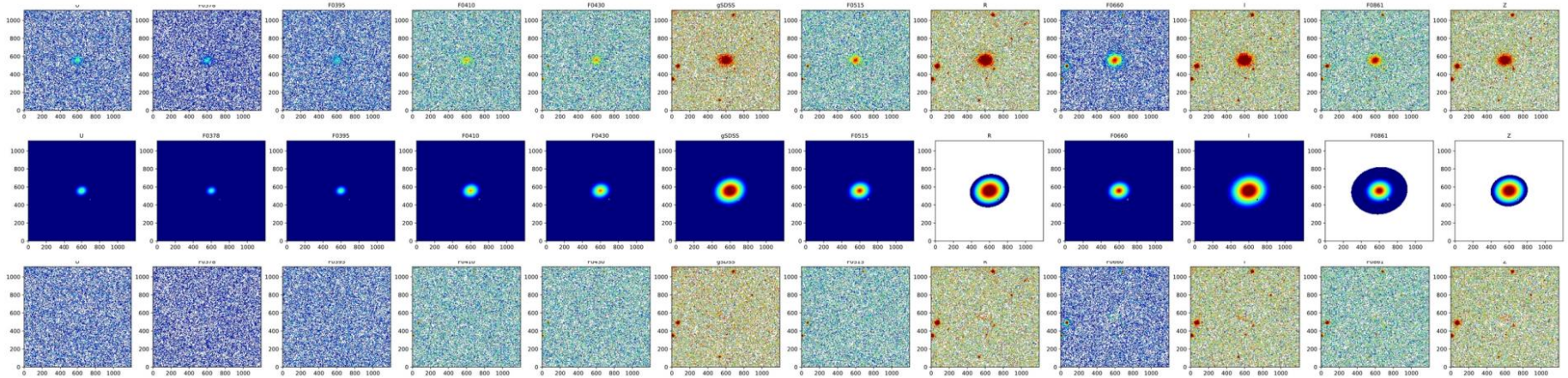


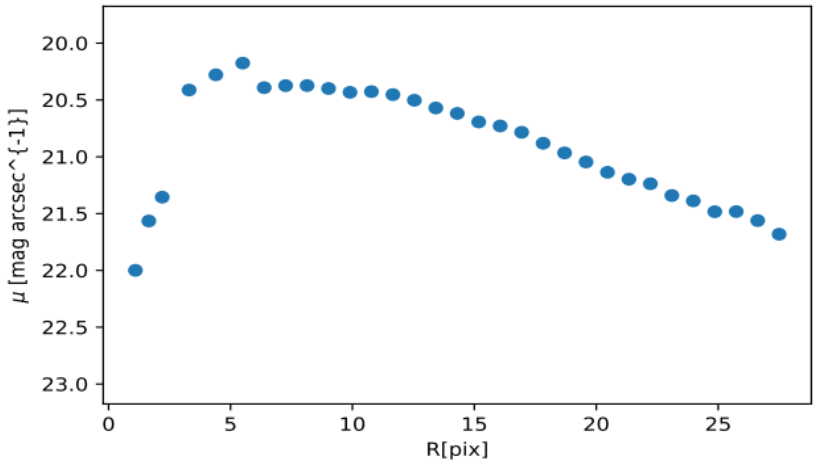


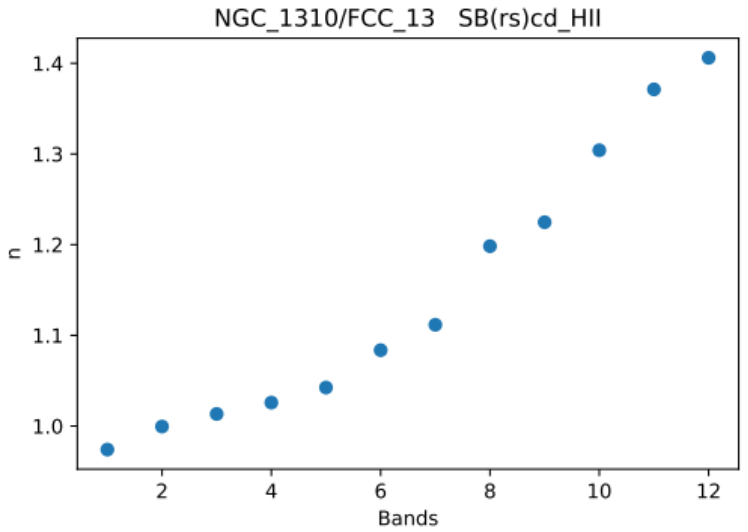


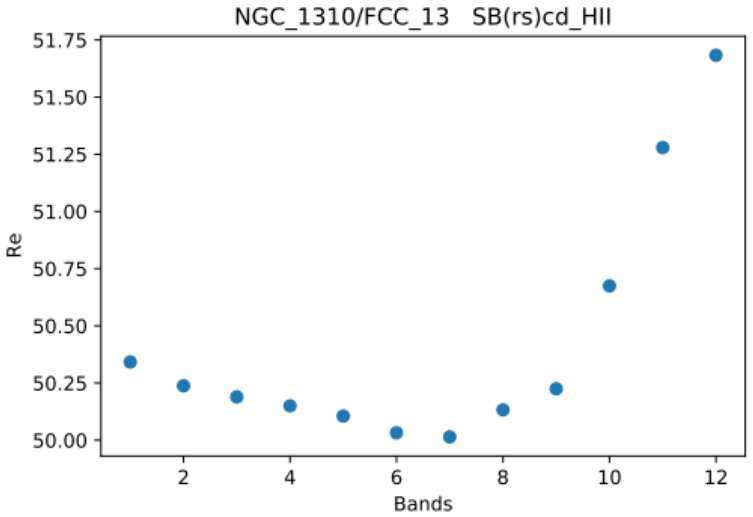


Multi-wavelength models as classifier

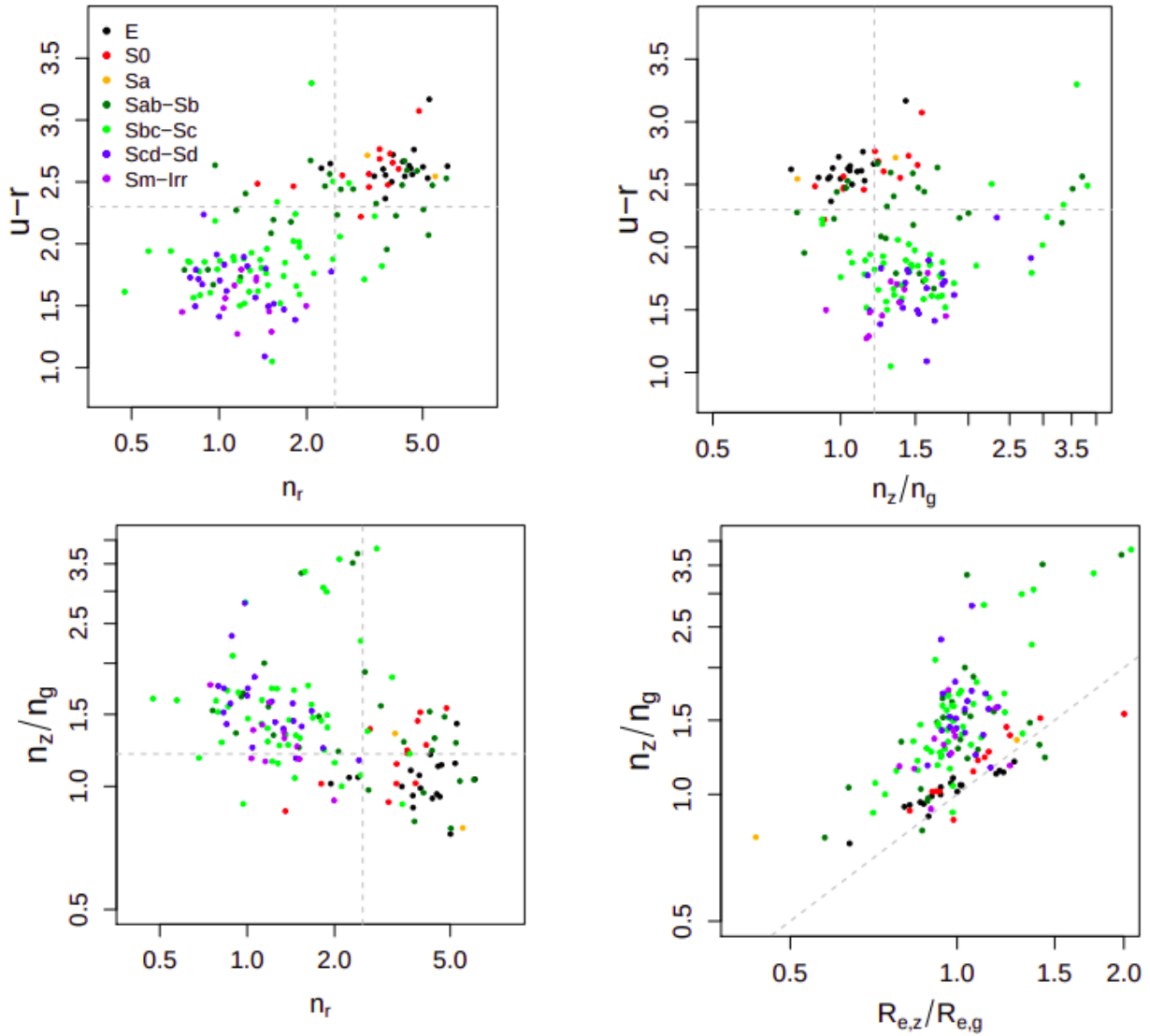






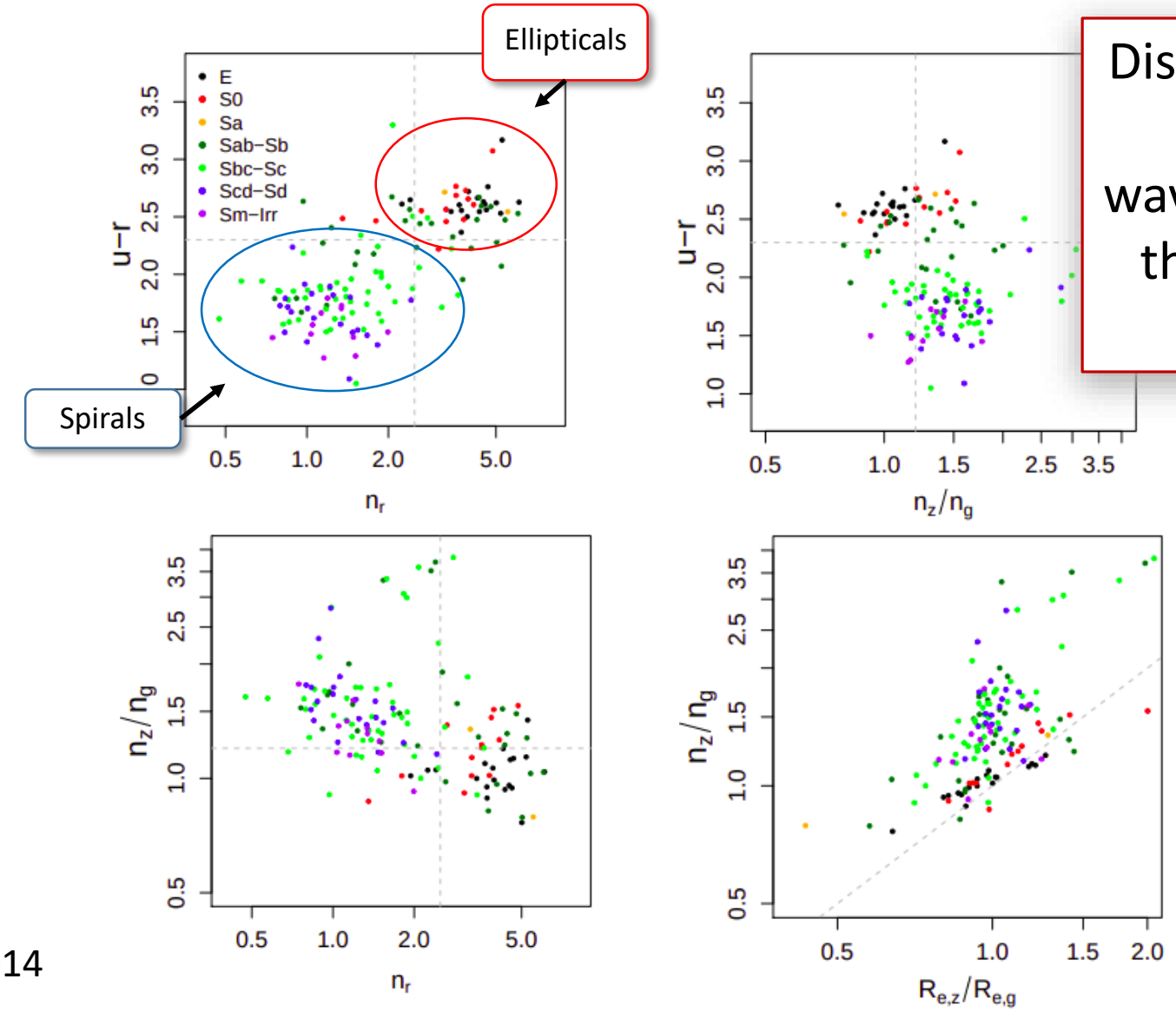


Multi-wavelength models as classifier



Vika et al, 2014

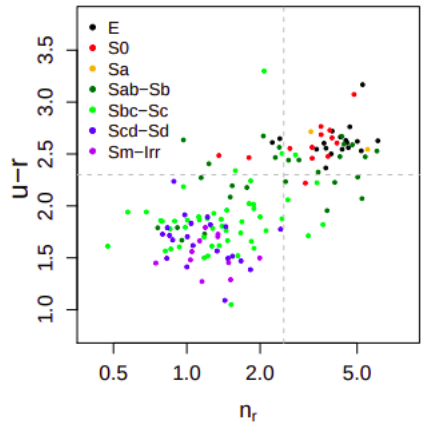
Multi-wavelength models as classifier

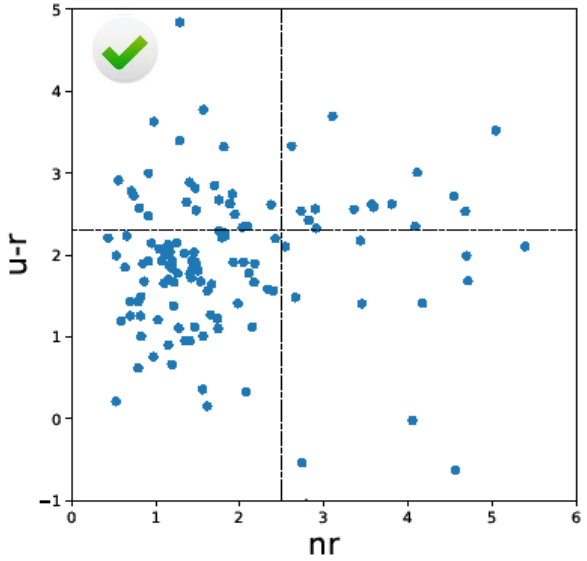


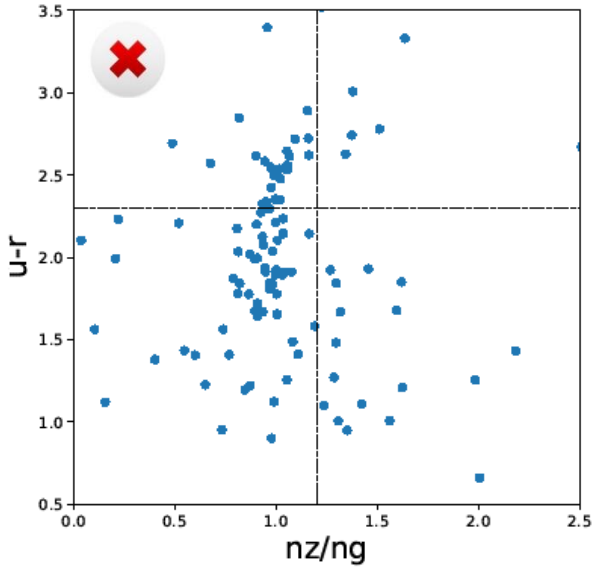
Disentangle morphological types thanks to the wavelength dependence of the Sérsic index and the half light radii

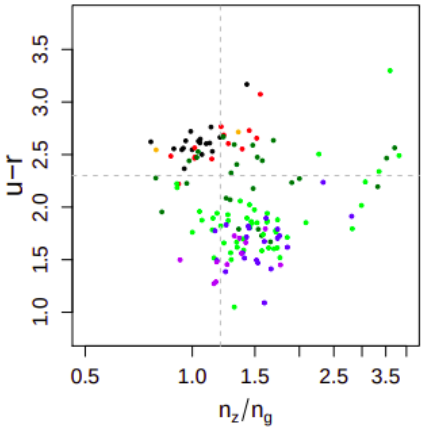
Vika et al, 2014

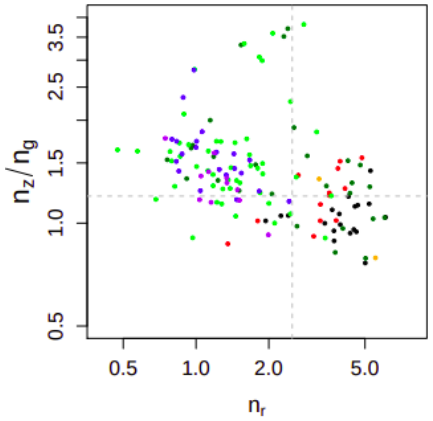
Multi-wavelength models as classifier

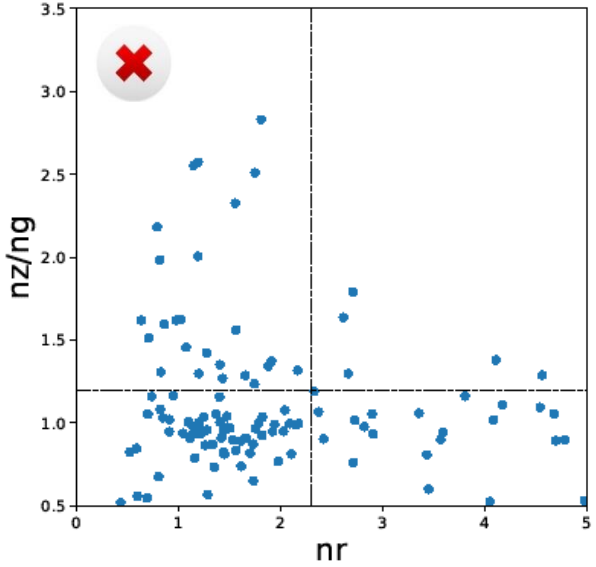


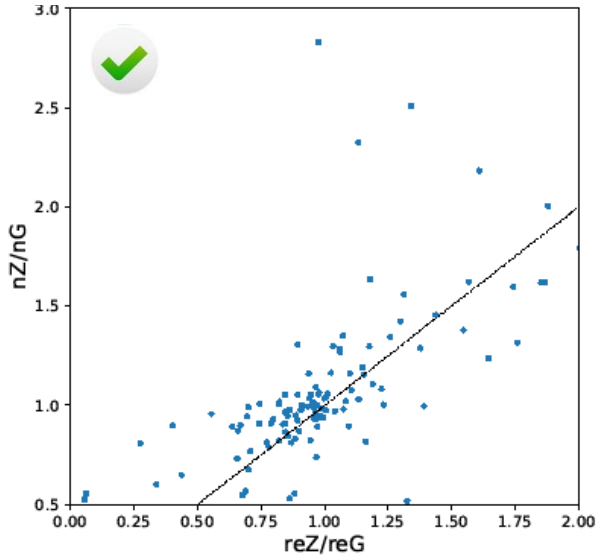


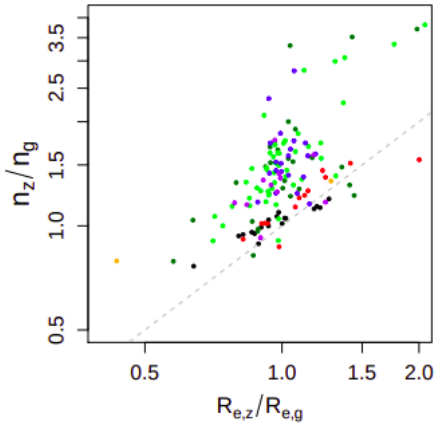




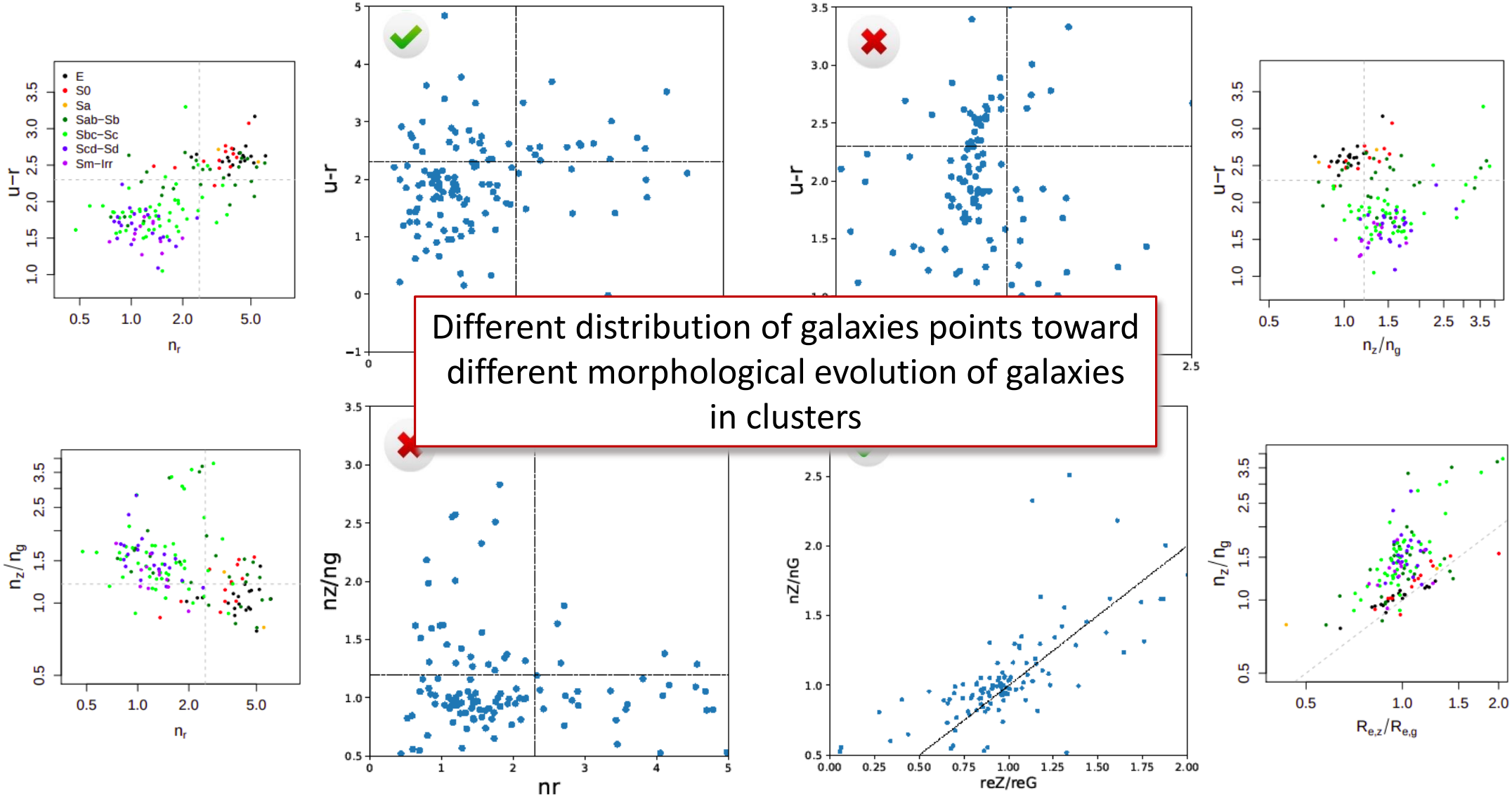








Multi-wavelength models as classifier



Different distribution of galaxies points toward different morphological evolution of galaxies in clusters

Next steps …

- Better Morphological classification to be compared with the visual one - non parametric classification

- Retrieve stellar populations properties of cluster members and bulges and discs

- Compare with Fornax like clusters from simulations

- Compare field-cluster galaxy properties to investigate quenching and morphological transformation

- Additional ideas are welcome!

Thank you!

FORNAX discussion section

Today at 3 pm (Br)