NOVEL TECHNIQUE TO CHARACTERIZE THE MERGING CHANNEL OF MASSIVE GALAXIES

LUIS PERALTA DE ARRIBA[1,2,⋆], MARC BALCELLS[3,1,2], IGNACIO TRUJILLO[1,2] AND JESÚS FALCÓN-BARROSO[1,2]

[1]Instituto de Astrofísica de Canarias (IAC), E-38200 La Laguna, Tenerife, Spain

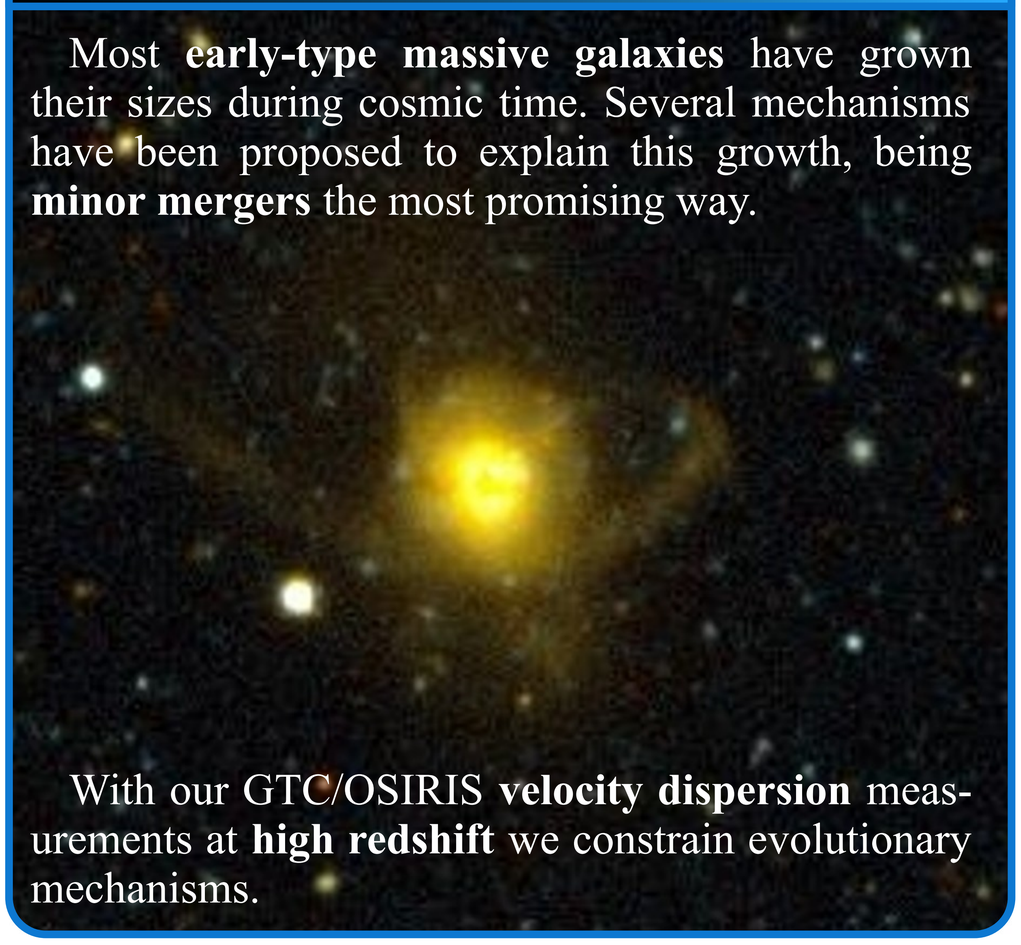
[2]Universidad de La Laguna, Departamento de Astrofísica, E-38206 La Laguna, Tenerife, Spain

[3]Isaac Newton Group of Telescopes, E-38700 Santa Cruz de La Palma, Islas Canarias, Spain

[⋆]E-mail: peralta@ing.iac.es

ABSTRACT

Most **early-type massive galaxies** have grown their sizes during cosmic time. Several mechanisms have been proposed to explain this growth, being **minor mergers** the most promising way.



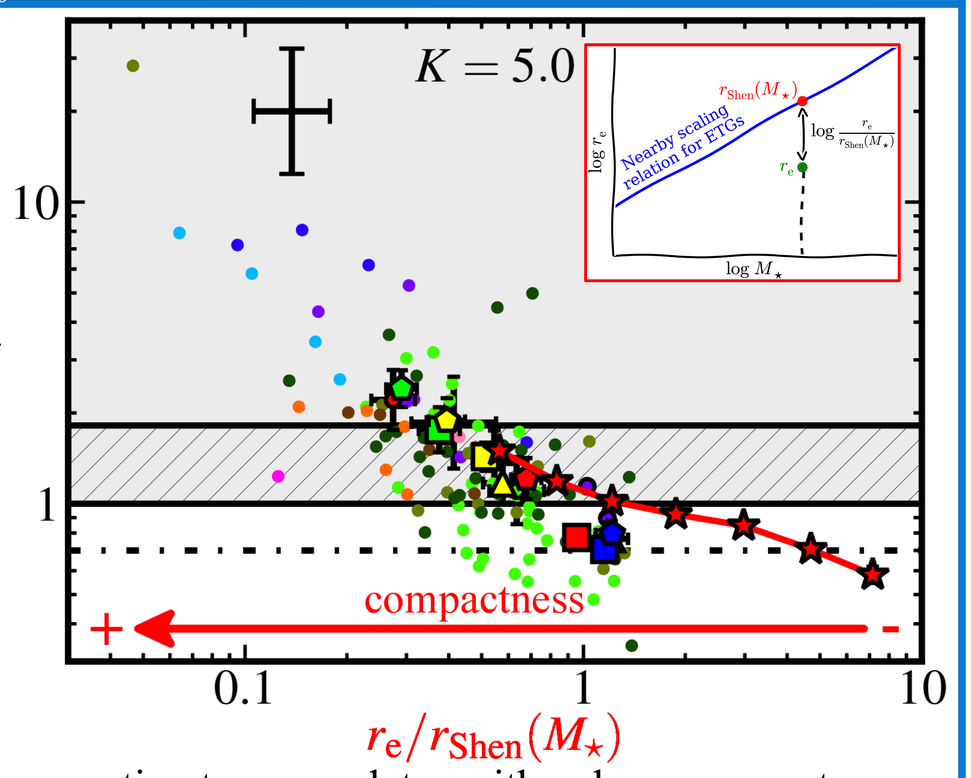
With our GTC/OSIRIS **velocity dispersion** measurements at **high redshift** we constrain evolutionary mechanisms.

DYNAMICAL MASSES OF COMPACT GALAXIES ARE UNPHYSICAL: $M_{\rm dyn} < M_\star$!!!

Stellar masses from stellar population synthesis models

$$\frac{M_\star}{M_{\rm dyn}}$$

Dynamical masses from virial theorem and homology, i.e. $M_{\rm dyn} = K\sigma_{\rm e}^2 r_{\rm e}/G$



Discrepancy between mass estimators correlates with galaxy compactness: The more compact a galaxy, the more unphysical its $M_\star/M_{\rm dyn}$

THE TECHNIQUE

STEP 1

Determine the stellar mass plane:

- Virial theorem and homology predict

$$M_\star \propto \sigma_{\rm e}^2 r_{\rm e}$$

- Using stellar masses, PdA14 and PdA15 proposed non-homology

$$M_\star \propto \left(\frac{r_{\rm e}}{r_{\rm Shen}(M_\star)}\right)^{\alpha} \sigma_{\rm e}^2 r_{\rm e}$$

STEP 2

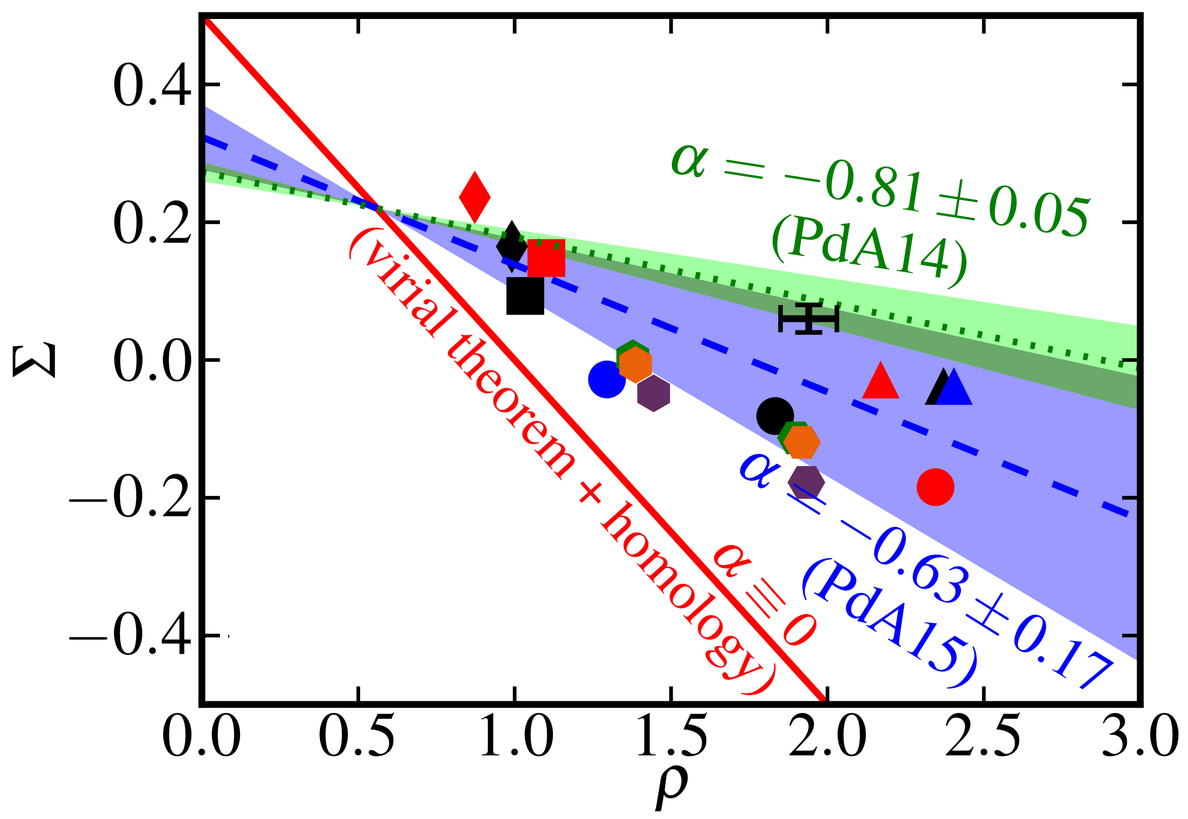
Interpret the stellar mass plane as a constraint on a generic evolutionary mechanism:

$$\left(\frac{r_{\rm e}^{\rm f}}{r_{\rm e}^{\rm i}}\right) = \left(\frac{M_\star^{\rm f}}{M_\star^{\rm i}}\right)^{\rho}$$

$$\left(\frac{\sigma_{\rm e}^{\rm f}}{\sigma_{\rm e}^{\rm i}}\right) = \left(\frac{M_\star^{\rm f}}{M_\star^{\rm i}}\right)^{\Sigma}$$

STEP 3

Compare with Σ and ρ from merger simulations. Homology is ruled out for merger remnants (**see Figure**). Potentially, the technique allows to establish the relative importance of minor and major mergers.



DRY-MERGING SIMULATIONS

Hilz et al. (2012)

■	1:1 ~~DM~~	~~AM~~	
♦	1:1 DM	AM	
●	1:10 ~~DM~~	~~AM~~-c	
▲	1:10 DM		

Tapia et al. (submitted)
(Merger histories from cosmological hydrodinamical simulations)

Frigo & Balcells (in prep.)

⬟	Merger tree A	$n = 4$
⬢	Merger tree B	$n = 2$
		$n = 1$

x:y Mass ratios of satellites
DM With (or without) dark matter
AM Orbits with (or without) angular momemtum
-c Compact satellites
n Sérsic index

REFERENCES

- Peralta de Arriba L. et al., 2014, MNRAS, 440, 1634 (**PdA14**)
- Peralta de Arriba L. et al., 2015, MNRAS, 453, 704 (**PdA15**)
- *Image taken from* van Dokkum P. G., 2005, AJ, 130, 2647

DOWNLOAD THIS POSTER

Get this poster from the web-page of *Traces of galaxy formation* group:
www.iac.es/project/traces