From UV to Visible Light: Unveiling the Secrets of Galaxy Size Evolution in the HSC+CLAUDS[1]

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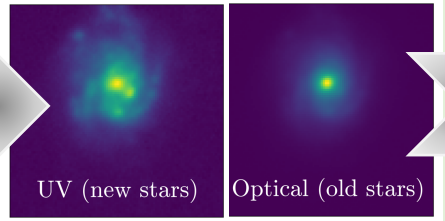
Motivation

Evolution of galaxy morphologies tells us about the **physical processes shaping galaxies** in the Universe. Analysis using rest-frames UV (tracing star-forming regions) and optical (tracing the bulk of the stellar population) wavelengths is crucial.

Data

~18 deg^2 in 6 filters: CFHT CLAUDS[2] (*U*) and Subaru HSC[3] (*g*, *r*, *i*, *z* & *y*)
Mass & redshift: $M_*>10^{9.5}M_\odot$; 0.1<z<0.9
Star-forming galaxies (SFGs): 200,000
Quiescent galaxies (QGs): 80,000
Rest-frames: 3000Å (UV) & 5000Å (optical)



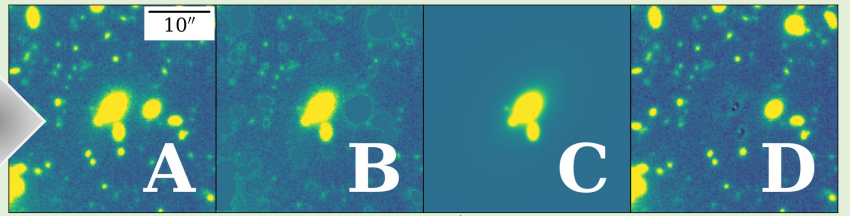


Figure 1: Sérsic profile fitting using GALFIT[4] (A) image cut-out, (B) masked image, (C) best-fit models of the target galaxy & bright neighbours and (D) residual image

Cluster Core vs Field

- QGs are smaller in clusters than in the field
- UV size growth is faster in clusters
- Size growth through newcomers

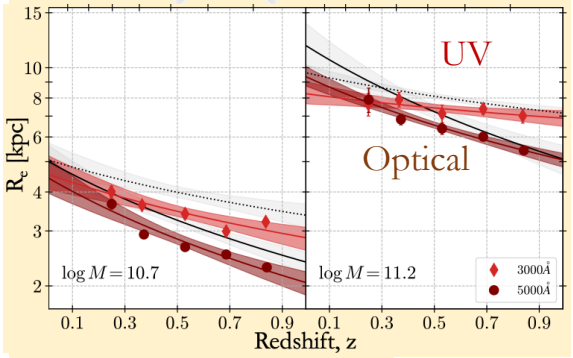


Figure 5: Size evolution of QGs before (black) and after (coloured) removing progenitor bias[1]

- QGs are larger in rest-UV, but faster growth in optical.
- Newcomer contribution (**progenitor bias**): ~20%
- The speed of their size growth is driven by **mergers** and **accretion**.

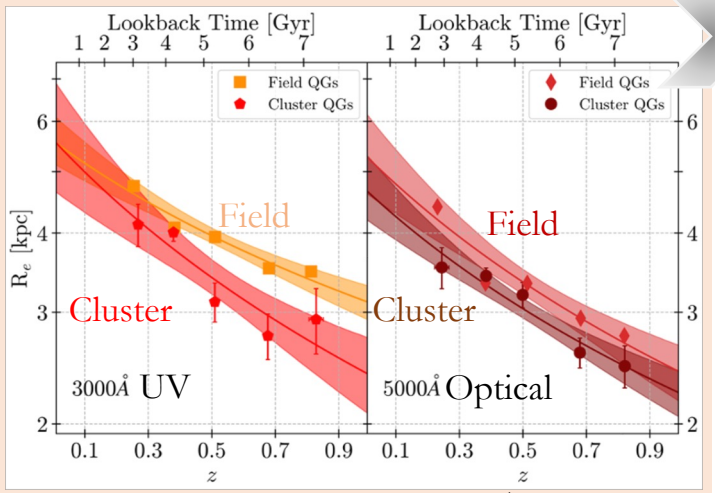


Figure 6: Size evolution of massive (log $M_*/M_\odot$ =10.7) QGs in rest-UV (left) and rest-optical (right) wavelengths [PRELIMINARY RESULTS]

Conclusions

1. **Growth of bulges** drives the SFG size evolution at z<1 (Figs 3 & 4)
2. **Progenitor bias** and **mergers** drive QG size growth (Fig 5)
3. QGs are smaller in clusters than in the field (Fig 6)
4. QGs grow faster in clusters due to **newcomers** (Fig 6)

[1]George A., et al., 2024, MNRAS, 528, 4797
[2]Sawicki M., et al., 2019, MNRAS, 489, 5202
[3]Aihara H., et al., 2019, PASJ, 71, 114
[4]Peng et al. 2010, AJ, 139, 2097

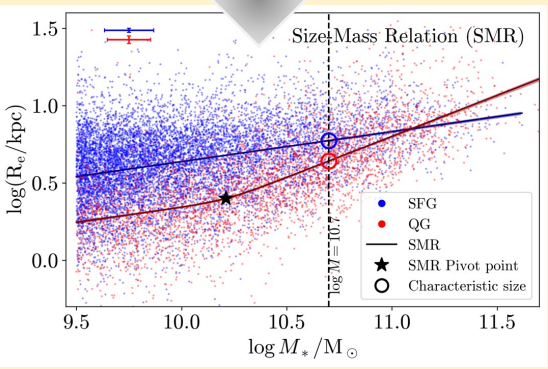


Figure 2: The Size-Mass Relation (SMR) for SFGs & QGs. The best-fit SMRs are shown as solid lines with their credible intervals as shaded regions. The slope of the QG SMR changes around the pivot point.

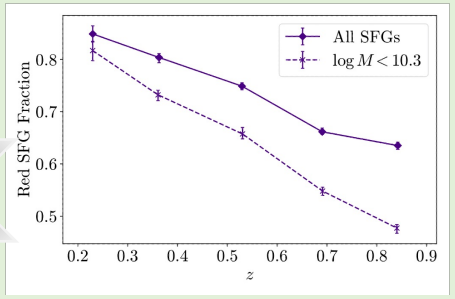


Figure 4: Evolution of the fraction of red (U-V>1) galaxies among SFGs[1]

- Blue SFGs (U-V<1)
- Red SFGs (U-V>1):
  - * More massive
  - * More concentrated
  - * Smaller size
- Fraction of red SFGs increases with time (**Fig 4**)

>>>**growth of bulges**<<<

* SFGs are larger in UV (**Fig 3**)
* SFGs at z<1 are not growing as fast as at higher z's
* Why?

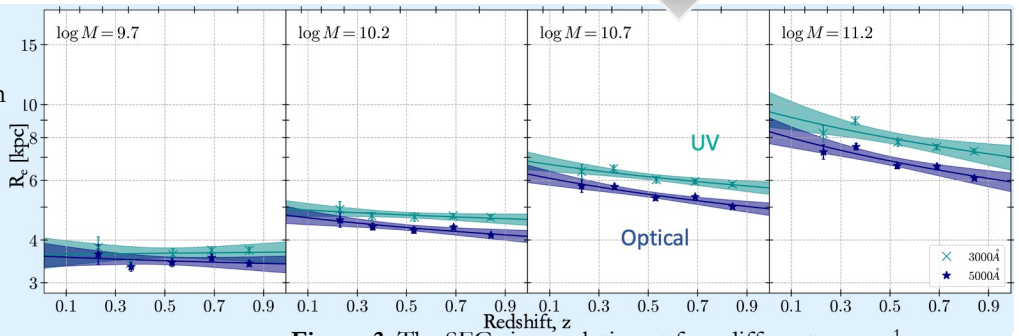


Figure 3: The SFG size evolution at four different masses[1]