The Evolving Mass-Size Relation of UV-Bright and Sub-mm Galaxies to z = 3.5

Moein Mosleh

Rik J. Williams , Marijn Franx, Mariska Kriek

Leiden Observatory, Universiteit Leiden, The Netherlands

E-mail: mosleh@strw.leidenuniv.nl

Introduction

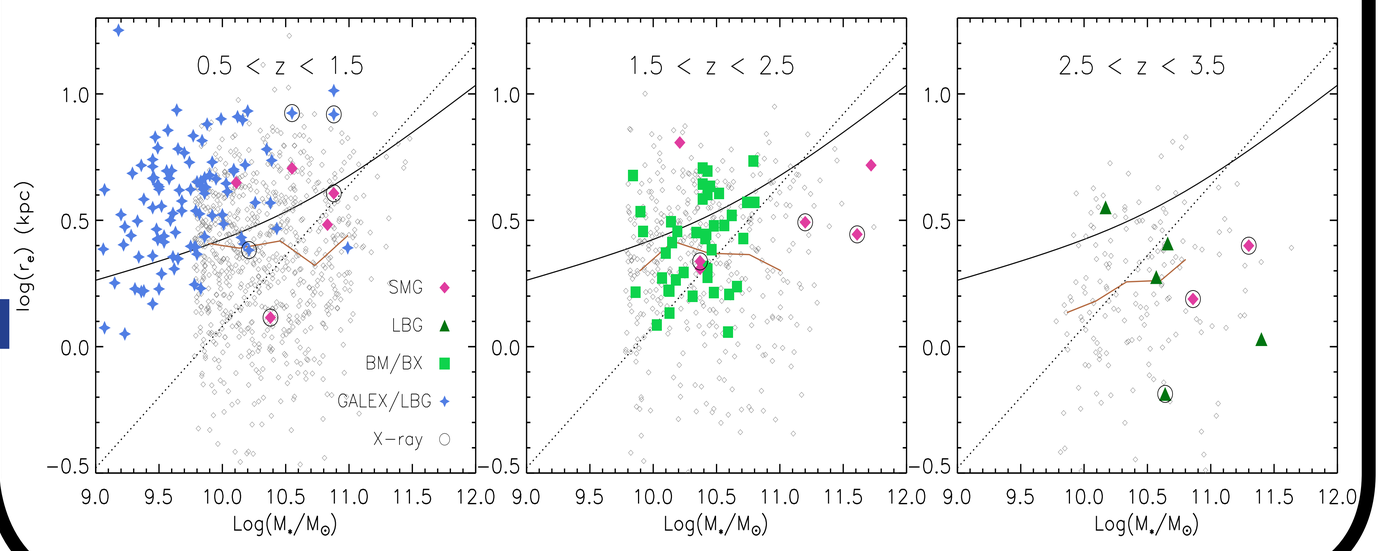
Recent studies provide evidence that sizes of galaxies at high redshifts were smaller in comparison with galaxies of similar mass in the local universe. However, most size studies at high redshift were based on photometric redshifts.

We have performed the first size evolution study of UV-bright and Sub-mm galaxies with spectroscopic redshifts in the GOODS-North Field to verify previous results based on photometric redshifts. We derived half-light radii of galaxies in the rest-frame optical up to z ~ 3.5. Sizes are measured from K_S-band images from the Subaru 8 m telescope.

Sizes of UV-Bright Galaxies

The figure below shows the stellar mass-size distribution for UV-bright galaxies (green and blue symbols) in three redshift bins compared to the galaxies from CDF-South (Franx et al. 2008) (gray dots). The solid and dotted black lines are the size-mass relations for star-forming and quiescent galaxies, respectively, at z~0 from Shen et al. (2003).

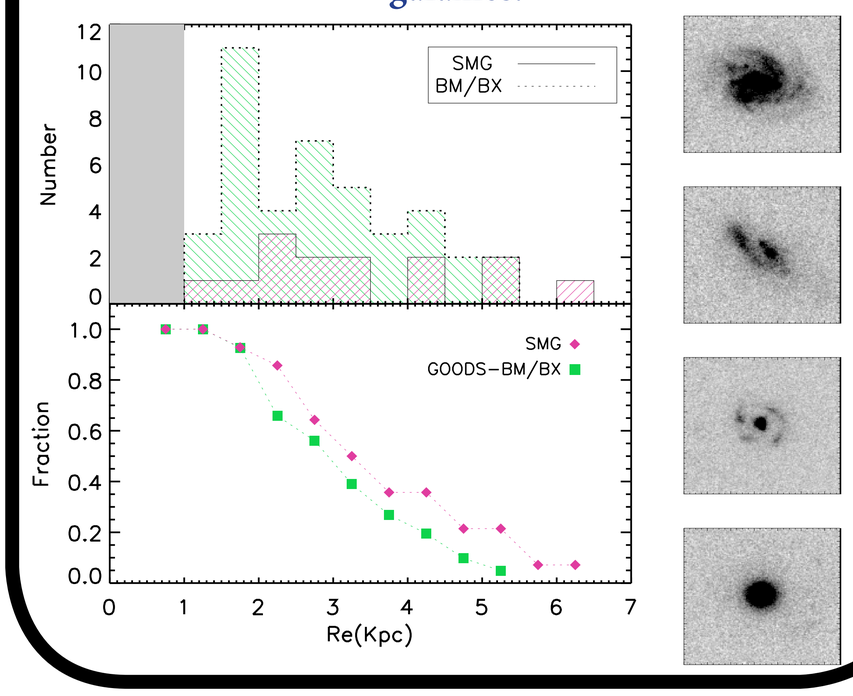
At each redshift, the UV-bright galaxies are larger than normal field galaxies at the same stellar mass. Our results confirm the strong evolution of the size-mass relation for star-forming galaxies up to high redshift.



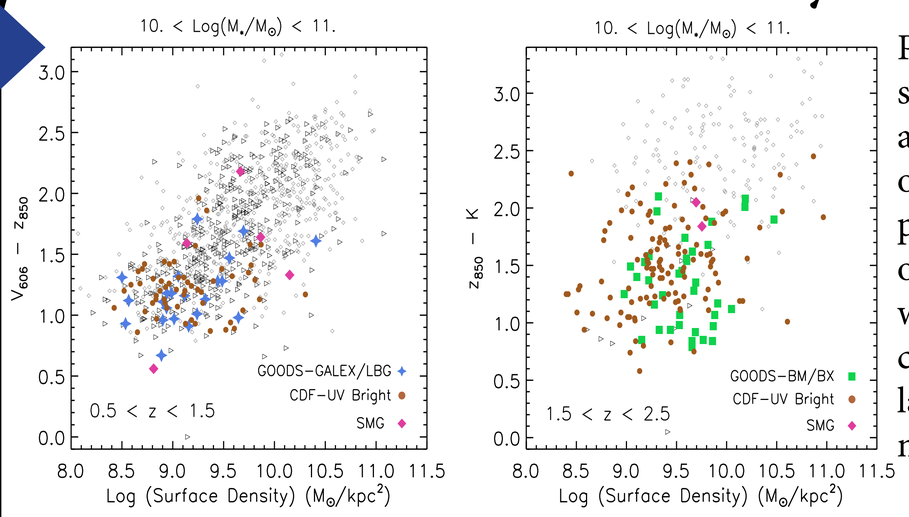
Sizes of Sub-mm Galaxies

The position of SMGs on the size-mass plane provides clues about their relation to other galaxy populations. We compare their sizes and masses to the BM/BX galaxies at z~2. The median effective radius of SMGs with stellar masses of 10^{10} - 10^{11} is 2.65±0.65 kpc which is similar to BM/BX galaxies at the same mass range 2.68±0.19 kpc.

Although our sample of SMGs is small, we find no significant difference in the sizes of submm and UV-bright galaxies.

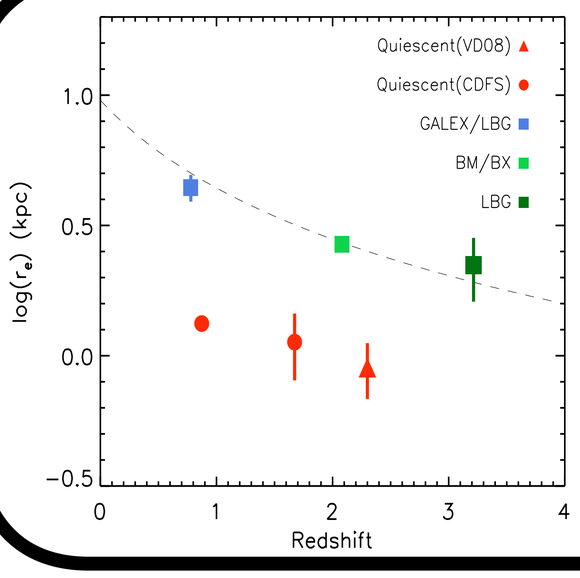


Color-Surface Density Relation



Previous studies have found the strong correlation betwen color and stellar mass surface density of galaxies, at z=0-2, based on photometric redshifts. By means of our large sample of galaxies with secure redshifts, we have confirmed that the tight correlation between color and stellar mass surface density holds out to high redshifts.

The stellar mass densities of blue star-forming galaxies are lower than those of red quiescent ones verifying that the galaxies with higher specific star-formation rates are larger than the ones with lower specific star-formation rates.



Summary & Conclusion

We have performed the first size evolution study of UV-bright galaxies with spectroscopic redshifts at a wide range of redshifts (up to z~3). We find that:

- **UV-bright galaxies evolve strongly as $(1+z)^{-1.11\pm0.13}$ confirming previous studies based on photometric redshifts.**
- **UV-bright galaxies are significantly larger than quiescent galaxies with the median difference is 0.45±0.09 dex**
- **SMGs have half-light radii similar to UV-bright galaxies of the same mass.**

References

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