PROPERTIES OF HIGH z GALAXIES IN THE ELTs ERA

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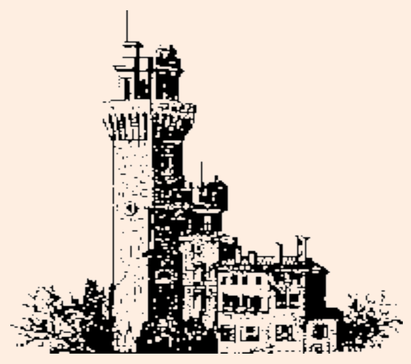


INTRODUCTION

Understanding the assembly history of galaxies is of paramount importance for answering fundamental questions about the processes of formation and evolution of galaxies and their associations (groups, clusters, superclusters, etc). To investigate these questions it is mandatory to probe the properties of galaxies over a significant range of cosmic time. In particular it is of extreme relevance to be able to characterize the galaxies at high redshift (i.e. at cosmic times as close as possible to the epoch of reionization). HST images of deep fields have shown that high z galaxies are much more compact that those of similar mass/luminosity in the present epoch. This size evolution is yet not well understood and may depend on the galaxy morphology, star formation activity and environments.

The extraordinary sensitivity and spatial resolution of the future extremely Large Telescopes will allow us to characterize the photometrical and structural properties of high redshift galaxies in spite of their very small size. With such future facility it will be possible to derive both accurate photometry and detailed morphology of very distant galaxies that are mandatory to tackle fundamental problems on the processes of galaxy formation and evolution. These results are also compared with the expected capabilities of NIRcam at JWST.

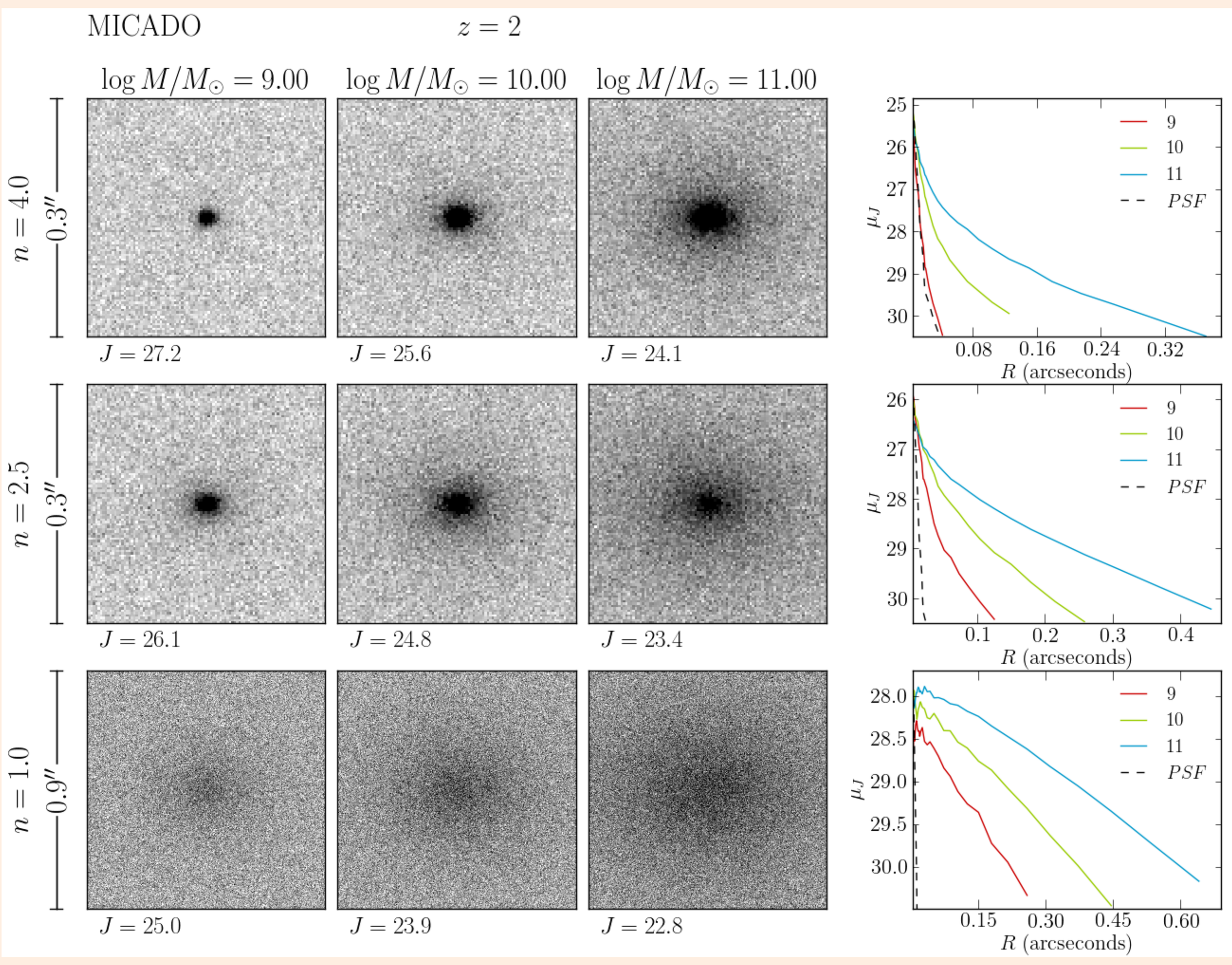
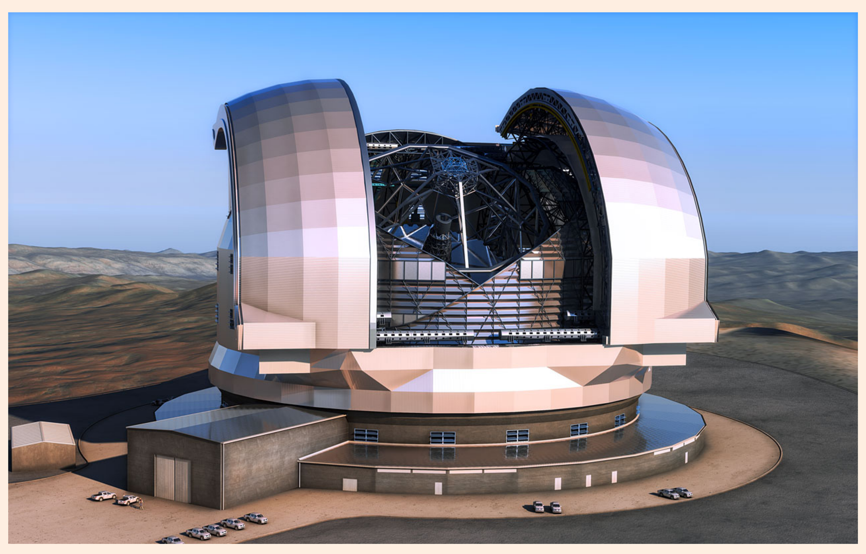


Figure 1A Simulated images of galaxies of different mass and morphology (Sersic index n=1,2.5,4) at z = 2 with MICADO@EELT. Filter J (3h exposure). Apparent AB magnitude is given in the bottom left of each panel. RIGHT panels: Average radial surface brightness profiles (color solid lines) of the galaxies compared with the PSF (grey dashed line).

IMAGE SIMULATION AND ANALYSIS

In order to evaluate the E-ELT capabilities to derive the properties (effective size, morphology, …) of high redshift galaxies we have produced a large set of simulated images, and their subsequently performed analysis with GALFIT to retrieve the basic galaxy parameters : Sersic index, half light radius and total magnitude. The simulations adopt the expected performances of the near-IR imagers MICADO at the E-ELT for galaxies at z ~ 2 and z ~ 3 spanning a mass range from 10^9 to 10^{11} $M_{\odot}$, and galaxy sizes, magnitude and colors are obtained from the presently available scaling relations for high z objects.



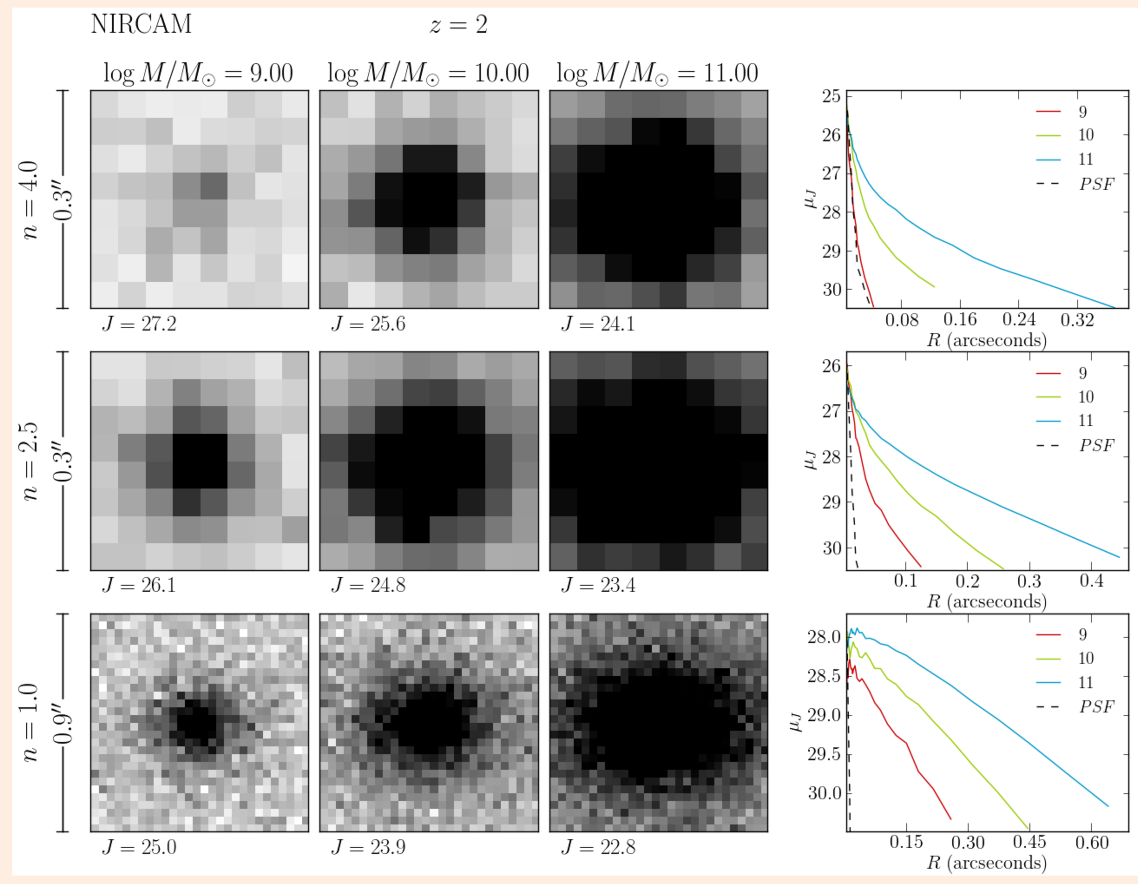


Figure 1B Simulated images of galaxies of different mass and morphology (Sersic index n=1,2.5,4) at z = 2 with NIRcam@JWST. Filter J (3h exposure). Apparent AB magnitude is given in the bottom left of each panel. RIGHT panels: Average radial surface brightness profiles (color solid lines) of the galaxies compared with the PSF (grey dashed line).

RESULTS

We found that MICADO will provide extremely accurate measurements of the structural parameters of high redshift galaxies. For galaxies at z = 2 it will be possible to determine their effective radii and morphology (Sersic index) with an accuracy of few percent for galaxies with stellar mass down to 10^9 $M_{\odot}$ and angular size > 20 mas (corresponding to only 0.15 kpc !!). Also for galaxies at z = 3 a similar accuracy is found down to $10^{9.5}$ $M_{\odot}$ (see Figure 2) . It is worth to note that at the same stellar mass galaxies with steeper profiles (n~4) are harder to characterize. Such great accuracy for the structural parameters allows to probe the color gradient of these galaxies with unprecedented reliability. (see Figure 3). Full details of these simulation are given in Gullieuszik+ 2015 (in preparation).

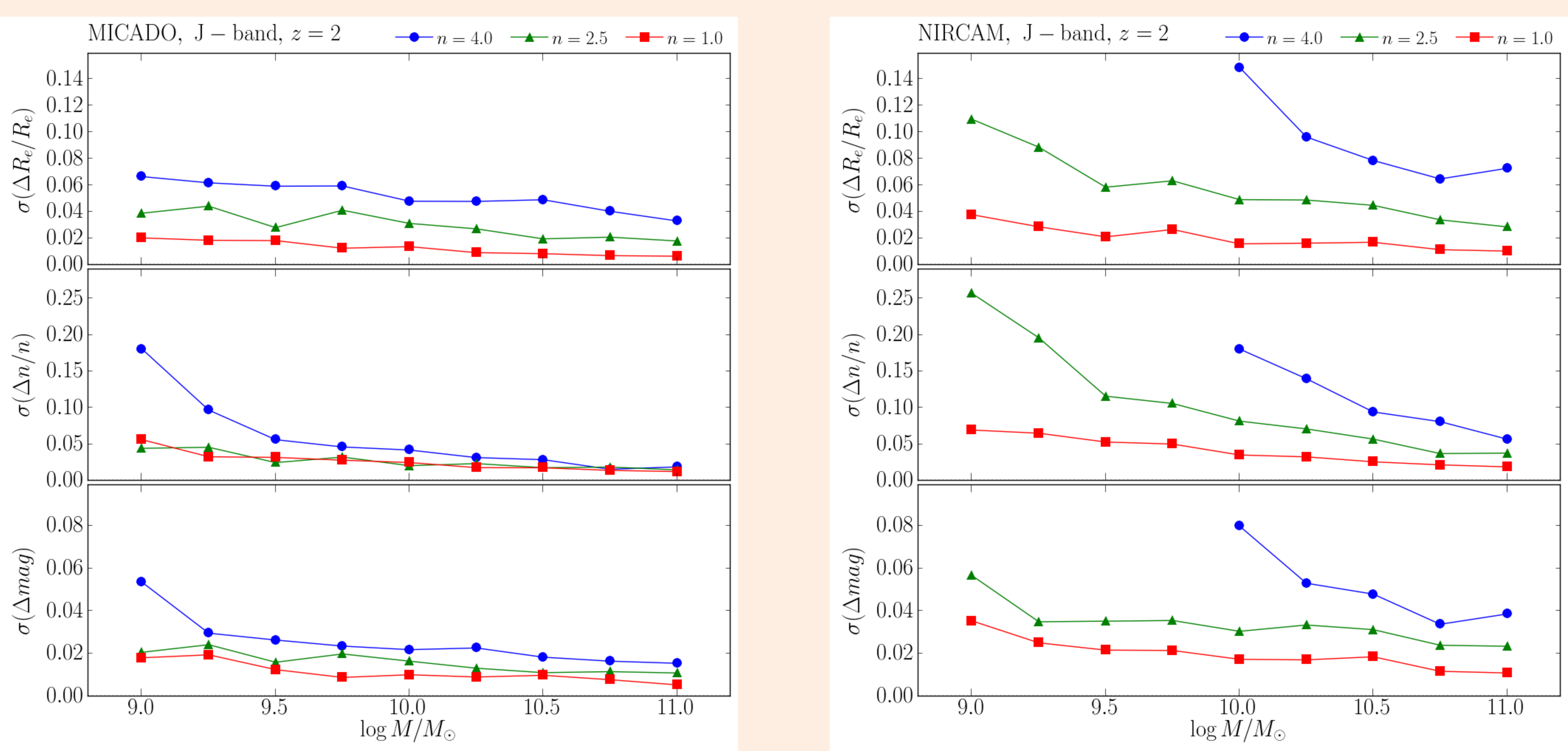


Figure 2 Uncertainty on the effective radius Re, Sersic index n, and total magnitude of simulated galaxies with various morphology at z = 2. The case of MICADO@EELT (left panels) is compared to the case of NIRcam@JWST (right panels)

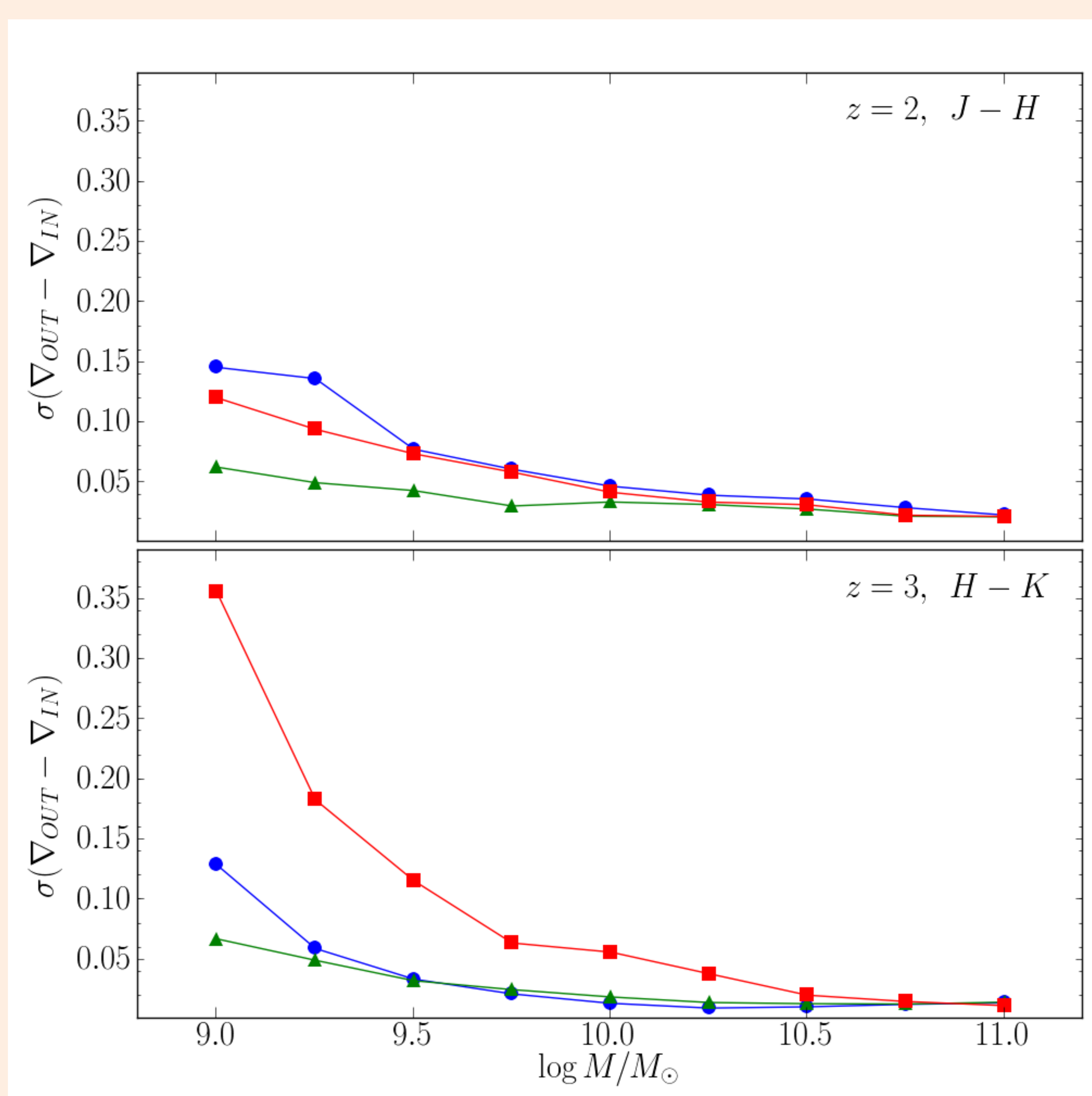


Figure 3 Uncertainty in the color gradient for galaxies of different stellar mass and Sersic index as obtained from simulations of high z galaxies observed with MICADO@E-ELT. The J-H color (top) and H-K color (bottom) correspond to the rest frame U-V at z =2 and z=3, respectively. Color codes are the same as in Figure 2.

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