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Environmental factors affecting Galaxy Morphology

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ABSTRACT

Key words:

1 INTRODUCTION

2 DATA

In this analysis, we consider the COSMOS sample of galaxies. COSMOS is a flux-limited, narrow deep field survey covering about 2 square degrees in the sky. High resolution images taken from the Hubble Space Telescope has allowed Claire **Ref** to fit parametric model to most of these galaxies including $Sersicn$ profile fits, 2 component bulge+disk fits, axis ratios etc. The morphological parameters of interest in this work will be axis ratios, Bulge-to-Total ratio, Sersic n and color $M_G - M_I$. We will analyze how these intrinsic properties of the galaxies depend on the environment in which they reside.

The photometric redshift values are noisy for $z > 1$ and the various fits to the galaxies are also not very reliable beyond the apparent magnitude (m) value of 23.5. We generate a volume-limited sample by applying a cut on luminosity such that only galaxies with $M_I < -22.0$ are considered. **Entire section on volume limiting has been omitted.**

[H]

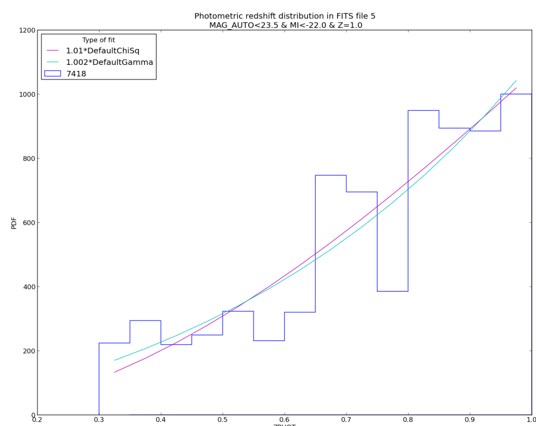

Figure 1.

3 MODELING THE REDSHIFT DISTRIBUTION

With the above cut, we assign values for overdensity by fitting a parametric model to the histogram of photometric redshifts. This one-dimensional density is justified because the area we are considering is small for $z < 1$. **?**. The figures show chi-squared and gamma functions fitted to the histogram. **Motivation for these functional forms?** For low z, the volume becomes too small to rely the overdensity values from our model fits and hence not considered. The curves are normalized such that the area under the curves is same as the number of galaxies considered. **Fig 3 - Histogram with fits** .

Overdensity in a redshift bin is defined as the ratio between the actual bin height and the value of the model. $\delta = N/N_{mod}$. If δ from both the fits is greater than 1.1, then we call that redshift bin as an overdense region whereas if δ from both the fits is less than 0.9, then we call that as an underdense region. **Fig 4 - overdensities vs redshift bins**.

We see that the region between $0.85 < z < 1.0$ is neither overdense nor underdense according to our model and hence is not going to be considered for further analysis. We use this to relax our luminosity cut to -20.8 so that the sample is still volume-limited for $z < 0.85$. One can also convince oneself that such an assignment of overdensities is sensible/robust by comparing the local mean co-moving density to the global mean co-moving density.

In the following section, we will compare and analyze the distribution of properties of the galaxies residing in the overdense regions.

Talk more about environments - Nature and nurture?

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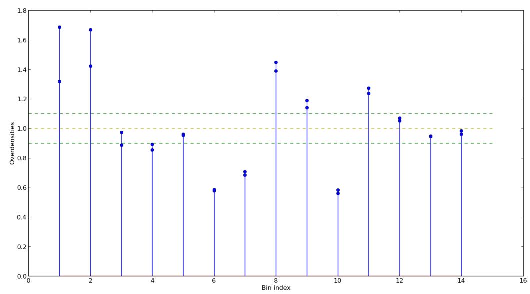

Figure 2.

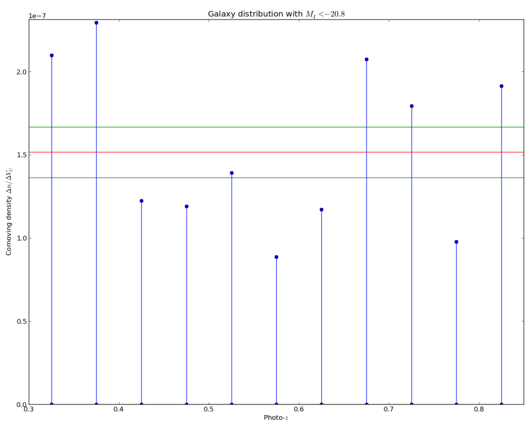

Figure 3.

4 IMPLICATIONS/COMPARISONS

4.1 Comparison plots

Insert Fig 6 - All histograms

Quantitative results of this comparison is presented in **Table 1**. Test statistic and p-values are obtained from Kolmogorov-Smirnov test (KS-test) and 2-sample Anderson-Darlington tests (AD-test) are given below

Table 1 - p-value matrix

Field	KS p-value	AD p-value
Apparent magnitude (m)	1.972e-86	0.0
i-band Luminosity (M_I)	1.459e-2	4.98e-3
Axis ratio (b/a)	4.277e-4	1e-4
Sersic n	1.593e-5	2e-5
Color ($M_G - M_I$)	2.889e-2	7.8e-4

Having a conventional threshold for p-value $p_{threshold} = 0.05$, we conclude that the distributions are inconsistent from the above table. When two randomly partitions of the sample is compared, the distributions are consistent with each other most of the time. The reason why the distributions do not agree might partly because of the environment and partly because of the evolution with redshift. The subsequent sections are dedicated to separate out their contributions.

5 AXIS RATIO (B/A)

to be transferred from the iPython notebook document