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# SEEDING THE LOCAL DISK GALAXY POPULATION

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RESUMEN

Mediante la técnica del empate de abundancias inferimos las relaciones locales masa estelar y bariónica-masa de halo ($M_{\rm s}$ & $M_{\rm b} - M_{\rm h}$) para galaxias centrales azules y rojas. La relación $M_{\rm b} - M_{\rm h}$ azul es sondeada a la luz de relaciones de escala observadas usando para esto modelos de galaxias de disco cargadas dentro de halos ΛCDM.

ABSTRACT

By means of the abundance matching technique we have inferred the local stellar & baryonic-halo mass ($M_{\rm s}$ & $M_{\rm b} - M$h) relations for central blue and red galaxies. Models of disk galaxies loaded inside Λ Cold Dark Matter (ΛCDM) halos are used to probe the obtained blue $M_{\rm b} - M_{\rm h}$ relation in the light of observed scaling relations.

*Key Words:* dark matter — galaxies: luminosity function, mass function — galaxies: spiral

## 1. INTRODUCTION

The connection between galaxy stellar ($M_{\rm s}$), baryonic ($M_{\rm b}$) and halo ($M_{\rm h}$) masses resumes key aspects of disk galaxy formation and evolution. The $M_{\rm s} - M_{\rm h}$ relation has been inferred recently for *all* galaxies by using direct and indirect methods (see e.g., More et al. 2011; Behroozi et al. 2010, and the references therein). One of them is the abundance matching formalism, based on the one-to-one monotonic relationship between the measured cumulative galaxy $M_{\rm s}$ function (GSMF) and the theoretical cumulative halo $M_{\rm h}$ function (HMF). We extend this formalism for estimating the $M_{\rm s} - M_{\rm h}$ (as well as the $M_{\rm b} - M_{\rm h}$) relations for blue (late-type) and red (early-type) *central* galaxies by separate (Rodríguez-Puebla et al. 2011). Then, models of disk galaxies loaded inside ΛCDM halos will be used to probe the obtained blue $M_{\rm b} - M_{\rm h}$ relation in the light of local observed scaling and dynamical relations.

## 2. THE HALOS AND THEIR GALAXIES

We use the blue and red GSMFs of central SDSS galaxies determined by Yang et al. (2009). The corresponding HMF to be matched with the blue GSMFs was obtained from the total ΛCDM (distinct) HMF but (i) by excluding those halos that suffered major mergers after $z = 0.8$ (theirs disks likely will be destroyed and not regenerated by $z \sim 0$), and (ii) by substracting the observed HMF of bounded groups with 3 or more members (late-type galaxies are rare as central objects in groups/clusters). For red galaxies, we take the complement of the obtained "blue" HMF to the total one.

The obtained $M_{\rm s} - M_{\rm h}$ relations and their $1\sigma$ uncertainty for central blue and red galaxies are plotted in Figure 1. We have found that these relations do not differ significantly from the one for "all" central galaxies. For $M_{\rm h} \gtrsim 10^{11.3}$, blue galaxies have slightly smaller stellar masses for a given $M_{\rm h}$ than red ones, the maximum difference in the means being a factor of 1.7. Previous inferences by using direct techniques (based on stacked weak-lensing and satellite-kinematics analysis) are also plotted in Figure 1; these techniques are yet very uncertain for low-mass galaxies. The dashed curves in Figure 1 are the averages of our inferred blue and red $M_{\rm b} - M_{\rm h}$ relations, where observational inferences of the gas content in blue and red galaxies were used in order to estimate the baryon mass functions from the corresponding GSMFs. The differences in $M_{\rm b} - M_{\rm h}$ between blue and red galaxies are now even less than in the stellar case. If galaxies would have a constant baryon fraction (e.g., equal to the universal one, $f_U$), then they would lie along the black dot-dashed lines in Figure 1. Astrophysical processes strongly bend the galaxy baryon fraction, $f_{\rm b} = M_{\rm b}/M_{\rm h}$, towards low and high masses, the peak of this fraction for blue and red galaxies being $f_{\rm b} = 0.028^{+0.018}_{-0.011}$ and $f_{\rm b} = 0.034^{+0.025}_{-0.014}$.

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