observed central blue and red *GSMF*s, taken here from YMB09. Note that in order to infer the $M_{\rm s}$–$M_{\rm h}$ relation of galaxy subpopulations (e.g., blue/red or central/satellite ones) solely from the overall *GSMF*, models for each subpopulation should be introduced, which greatly increases the uncertainty of the result. Regarding the *HMF*s to be matched with the corresponding observed central *GSMF*s, the theoretical *HMF* is decomposed into two functions –associated to halos hosting blue and red galaxies– based on empirical facts: blue galaxies are rare as central objects in groups/clusters of galaxies, and they should not have undergone late major mergers because of the dynamical fragility of disk (blue) galaxies. Nowadays, it is not clear whether or not the $M_{\rm s}$–$M_{\rm h}$ relation varies significantly with galaxy color or type. Previous studies that discussed this question were based on direct methods: the weak lensing (Mandelbaum et al. 2006) and satellite kinematics (More et al. 2011) techniques. The uncertainties in the results of these studies are still large, and can be subject to biases intrinsic to the sample selection and to effects of environment.

We also estimate here the galaxy baryon mass-halo mass relations, $M_{\rm b}$–$M_{\rm h}$[4], where $M_{\rm b}$= $M_{\rm s}$+ $M_{\rm g}$, by using the *GSMF*s combined with average observational determinations of the galaxy gas mass, $M_{\rm g}$, as a function of $M_{\rm s}$. The galaxy baryonic mass fraction, $f_{\rm b}$= $M_{\rm b}/M_{\rm h}$, and its dependence on mass is important for constraining models and simulations of galaxy evolution, and is also a key input for some approaches, implemented to model the most generic population of galaxies, namely *isolated (central) disk galaxies* (e.g., Mo, Mao, & White 1998; Firmani & Avila-Reese 2000; van den Bosch 2000; Stringer & Benson 2007; Dutton et al. 2007; Gnedin et al. 2007; Dutton & van den Bosch 2009). In these and other studies, it was shown that several disk galaxy properties, correlations, and their scatters depend (or are constrained) by $f_{\rm b}$. In a similar way, the $f_{\rm b}$–$M_{\rm h}$ dependence is expected to play some role in the results of structural and dynamical models of spheroid-dominated galaxies.

In § 2 we describe the method and the data input. The stellar/baryon mass-halo mass relations for the total, blue and red (sub)samples are presented in § 3. In § 4 we compare our results with other observational works, and discuss whether they are consistent or not with expectations of semi-empirical inferences. The summary and our conclusions are given in § 5.

[4]We assume that the galaxy baryonic mass is included in the halo (virial) mass $M_{\rm h}$.

2. THE METHOD

The AM statistical technique is based on the hypothesis of a one-to-one monotonic increasing relationship between $M_{\rm s}$ (or $M_{\rm b}$) and $M_{\rm h}$. Therefore, by matching the *cumulative* galaxy stellar and halo mass functions, for a given $M_{\rm s}$ a unique $M_{\rm h}$ is assigned:

$$\int_{M_{\rm h}}^{\infty} \phi_h(M'_h)dM'_h = \int_{M_{\rm s}}^{\infty} \phi_s(M'_s)dM'_s, \qquad (1)$$

where ϕ_h is the overall *HMF* (distinct + subhalos) and ϕ_s is the overall *GSMF*; *distinct* halos are those not contained inside more massive halos. It is reasonable to link central galaxies with distinct halos. Therefore, in the case of using the *GSMF* for only central galaxies, the distinct *HMF* should be used for the matching. Since the main purpose of this paper is the inference of the $M_{\rm s}$–$M_{\rm h}$ (and the corresponding $M_{\rm b}$–$M_{\rm h}$) relation for blue (red) galaxies, (i) a *GSMF* that separates galaxies by color is necessary (the data to be used here are discussed in § 2.1), and (ii) a criterion to select the halos that will likely host blue (red) galaxies shall be introduced (see § 2.2.1).

In this paper we will not carry out an exhaustive analysis of uncertainties in the inference of the $M_{\rm s}$–$M_{\rm h}$ relation with the AMT. This was extensively done in BCW10 (see also Moster et al. 2010). In BCW10 the uncertainty sources are separated into three classes: uncertainties (i) in the observational inference of *GSMF*, (ii) in the dark matter HMF, which includes uncertainties in the cosmological parameters, and (iii) in the matching process arising primarily from the intrinsic scatter between $M_{\rm s}$ and $M_{\rm h}$.

2.1. *Galaxy and Baryonic Stellar Mass Functions*

In the last years, complete galaxy luminosity functions (and therefore, *GSMF*s) were determined for local samples covering a large range of luminosities (masses). The stellar mass is inferred from (multi) photometric and/or spectral data (i) by using average stellar mass-to-light ratios, depending only on color (inferred from application of stellar population synthesis –SPS– models to galaxy samples with independent mass estimates, e.g., Bell et al. 2003), or (ii) by applying directly the SPS technique to each sample galaxy, when extensive multi-wavelength and/or spectral information is available.

In both cases, a large uncertainty is introduced in the inference of $M_{\rm s}$ due to the uncertainties in the IMF, stellar evolution, stellar spectral libraries, dust extinction, metallicity, etc. Bell et al. (2003) estimated a scatter of ≈0.1 dex in their $M_{\rm s}/L$ ratios