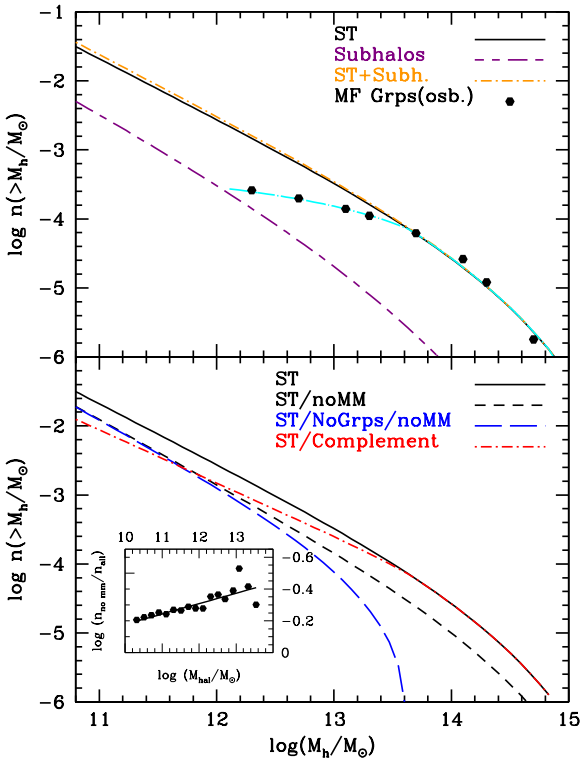

Fig. 3. Upper panel: Distinct S-T *HMF* for the cosmology adopted in this paper (solid black line), sub-halo mass function at $z = 0$ according to Giocoli et al. (2010, short-long-dashed purple line), and the sum of both (dot-dashed orange line). The solid dots are measures of the group/cluster mass function according to Heinämäki et al. (2003) and adequately corrected to our definition of virial halo mass; the dot-long-dashed cyan line is a eye-fit to the data. Lower panel: The same distinct S-T *HMF* (solid black line) shown in the upper panel but (i) excluding the halos that suffered late major mergers –since $z = 0.8$– (short-dashed black line) and (ii) excluding these halos and those of observed groups/clusters (long-dashed blue line). The latter is the *HMF* to be assigned to the sub-sample of central blue galaxies. The complement of this function to the total (S-T) one (dot-dashed red line) is the *HMF* to be assigned to the sub-sample of central red galaxies. The inset shows the ratio of number densities of halos that did not suffer major mergers since $z = 0.8$ to all the (distinct) halos according to measures in a cosmological N-body simulation (Colín et al. 2011, in preparation, see text). The fit to this ratio (solid line in the inset) is what has been used to correct the S-T *HMF* for halos thad did not suffer late major mergers. The color figure can be viewed online.

YMB09, ≈55% (≈45%) of the galaxies are in the blue (red) sub-samples for $M_s \gtrsim 3 \times 10^8\ M_\odot$. We may go one step further by proposing general observational/physical conditions for halos to be the hosts of blue (late-type) or red (early-type) galaxies. Note that the division of galaxies we do here is quite broad –just into two groups– and therefore very general conditions are enough.

Halos that host central blue and red galaxies are expected to have (i) a different environment, and (ii) a different merger history. We take into account these two factors in order to roughly estimate the *HMF* of those halos that will host today central blue and red galaxies.

Environment.- Blue (late-type) galaxies are rare in the centers of groups and clusters of galaxies (high-density environments; e.g., Norberg et al. 2001; Zehavi et al. 2005; Li et al. 2006; de Lapparent & Slezak 2007; Padilla, Lambas, & González 2010; Blanton & Moustakas 2009, and references therein). For example, in the SDSS YMB09 sample that we use here (see also Weinmann et al. 2006), among the groups with 3 or more members, the fraction of those with a central blue galaxy is only ≈20%, and most of these central galaxies have actually low masses. Therefore, cluster- and group-sized halos (more massive than a given mass) cannot be associated to central blue galaxies when using the AMT. This means that the halo mass function of groups/clusters of galaxies should be excluded from the theoretical *HMF* (Shankar et al. 2006).

Heinämäki et al. (2003) determined the *HMF* of groups with 3 or more members and with a number density enhancement $\delta n/n \geq 80$ from the Las Campanas Redshift Survey. The authors estimated the corresponding group virial mass on the basis of the line-of-sight velocity and harmonic radius of the group, in such a way that this mass was defined at the radius where $\delta n/n = 80$. The observational galaxy overdensity $\delta n/n$ is related to the mass overdensity $\delta\rho/\rho$ roughly through the bias parameter b: $\delta\rho/\rho = (1/b) \times \delta N/N$, where $b \approx 1/\sigma_8$ (Martínez et al. 2002). Hence, for $\sigma_8 = 0.8$, $\delta\rho/\rho \approx 64$; since the group selection was carried out in Tucker et al. (2000), where an Einstein-de Sitter cosmology was used, then $\rho = \rho_{\rm crit}$ in this case. In our case, the halo virial mass is defined at the radius where $\delta\rho/\rho \approx 340$ (see § 2.2); in terms of $\rho_{\rm crit}$, our overdensity is $340 \times \Omega_M = 92$. Therefore, the halo virial masses in Heinämäki et al. (2003) should be slightly larger than those used here. For the NFW halos of masses larger than $\sim 10^{13}\ M_\odot$, the differences are estimated to be factors of 1.10–1.20. We correct the group masses of Heinämäki et al. (2003) by 15%. In the upper panel of Figure 3, the corrected group (halo) mass function is reproduced (solid dots) and a eye-fit to them is plotted (dot-dashed cyan line).