The Past 7 Gyr of Red Galaxy Growth

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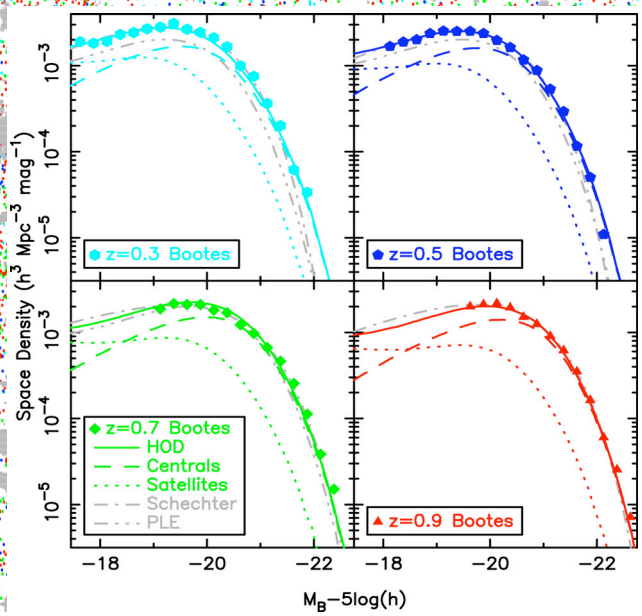
We have traced the past 7 Gyr of red galaxy stellar mass growth within dark matter halos. We have determined the halo occupation distribution, which describes how galaxies reside within dark matter halos, using the observed luminosity function and clustering of 40,696 0.2<z<1.0 red galaxies in Bootes.

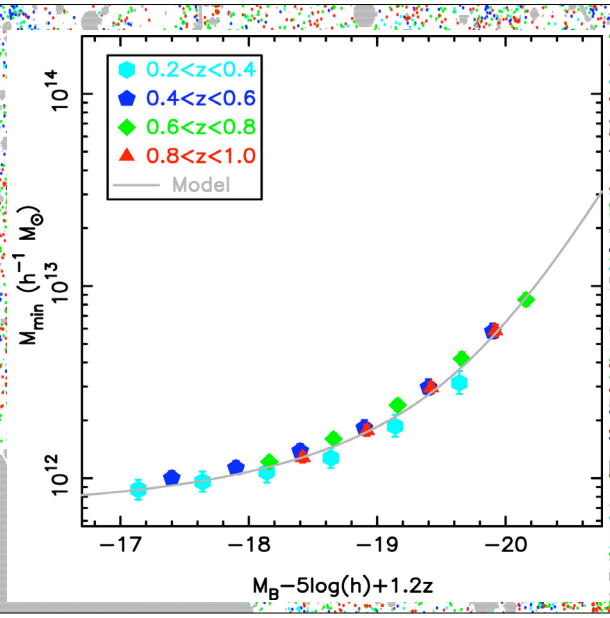
We do not observe any evolution of the relationship between red galaxy stellar mass and host halo mass, although we expect both galaxy stellar masses and halo masses to evolve. The stellar masses of the most luminous red central galaxies are proportional to halo mass to the power of a third. We thus conclude that halo mergers do not always lead to rapid growth of central galaxies. While very massive halos often double in mass over the past 7 Gyr, the stellar masses of their central galaxies typically grow by only 30%.

For a detailed discussion of our work, see

Brown et al., 2008, ApJ, 682, 937
White et al., 2007, ApJ, 655, L69
Brown et al., 2007, ApJ, 654, 858

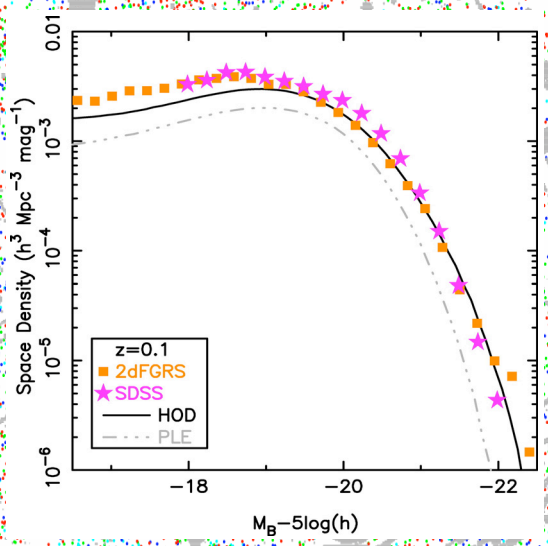


The evolving luminosity function of red galaxies. A pure luminosity evolution (PLE) model, without evolution of galaxy stellar masses, does not reproduce the observations. A model without evolution of the relationship between galaxy stellar mass and host halo mass (solid lines) reproduces the evolving clustering and luminosity function of red galaxies.



Dark matter halo mass as a function of central galaxy absolute magnitude. By adding 1.2z to the B-band absolute magnitudes, we compensate for the fading of the red galaxy stellar populations, making the x-axis a proxy for stellar mass. We do not observe any evolution of the relationship between galaxy stellar mass and host halo mass.

Half of $10^{11.9}$ Solar mass halos host a red central galaxy. In the highest mass halos, the luminosity of the central galaxy scales as halo mass to the power of a third. As a result, if mergers double halo masses between z=1 and z=0, central galaxy stellar masses will typically grow by only 30% over the same redshift range.



The SDSS and 2dF red galaxy luminosity functions of Blanton (2006, ApJ, 648, 268) and Madgwick et al. (2002, MNRAS, 333, 133). A pure luminosity evolution (PLE) model, normalised to the z=0.9 Bootes data, does not match the observations. A model without evolution of the relationship between galaxy stellar mass and host halo mass (solid line) is a better match to the observations than PLE. At low luminosities the offset between the model and data may be due to selection effects, while the model reproduces the luminosity function of the most massive galaxies.

0.2<z<0.4
0.4<z<0.6
0.6<z<0.8
0.8<z<1.0

Background Image : The sky distribution of the Bootes red galaxy sample. Galaxies are colour coded by their photometric redshift, while masked regions are shown in grey.