Red Galaxies Growing in Dark Matter Halos

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Abstract. To understand the slow growth of massive galaxies at $z < 1$, we have modeled how these galaxies populate dark matter halos. The models are constrained with the observed luminosity function and clustering of $z < 1$ red galaxies. In the most massive halos, much of the stellar mass resides within multiple satellite galaxies rather than a single central galaxy. Consequently, massive galaxies grow slowly within rapidly growing dark matter halos.

Keywords. galaxies: elliptical and lenticular, cD, galaxies: evolution, (cosmology:) dark matter

The most massive dark matter halos are predicted to grow rapidly via mergers at $z < 1$, and there has thus been an expectation that massive galaxies will also grow rapidly via mergers. Contrary to this expectation, recent observations show that massive galaxies grow slowly at $z < 1$. To understand why this is the case, we have constrained models of how galaxies populate dark matter halos using the observed luminosity function and clustering of $z < 1$ red galaxies (White *et al.* 2007, Brown *et al.* 2008). We find that the relationship between red galaxy stellar mass and host halo mass does not evolve significantly, although the masses of individual galaxies and halos are evolving. In the most massive dark matter halos, much of the stellar mass resides within multiple satellite galaxies and diffuse intra-cluster light, rather than a single central galaxy. We also find that the stellar masses of the most massive galaxies are proportional to halo mass to the power of a third. Consequently, the stellar masses of the largest galaxies grow slowly, even though they reside within rapidly growing dark matter halos.

References

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