# Are Halo and Galaxy Formation Histories Correlated?

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*(Submitted on 25 Jul 2011)*

The properties of dark matter halos, including mass growth, correlate with larger scale environment at fixed mass, an effect known as assembly bias. However, whether this environmental dependence manifests itself in galaxy properties remains unclear. We apply a group-finding algorithm to DR7 of the SDSS to estimate the halo mass of each galaxy and to decompose galaxies into those that exist at the centers of distinct halos and those that orbit as satellites within larger halos. Using the 4000-A break as a measure of star formation history, we examine the correlation between the quenched fraction of galaxies, f_q, and large-scale environment, rho. At all galaxy magnitudes, there is a positive, monotonic relationship between f_q and rho. We use the group catalog to decompose this correlation into the contribution from central and satellite galaxies as a function of halo mass. Because satellites are more likely to be quenched than central galaxies, the observed f_q-rho correlation is primarily due to variations of the halo mass function with environment, which causes a larger fraction of satellite galaxies at high rho. For low-mass central galaxies (Mgal <~ 10^10.0 Msol/h^2), there is no correlation between f_q and rho. These results are inconsistent with the strong assembly bias of dark matter halos seen in this mass regime if recent galaxy growth at all correlates with recent halo growth, as we demonstrate through a high resolution N-body simulation. We also find that the mean stellar age of quenched central galaxies is independent of rho at fixed Mgal, while the formation times of low mass halos vary significantly. We conclude that the processes that halt the star formation of low mass central galaxies are not correlated to the formation histories of their host halos, and old galaxies do not reside preferentially in old halos. (Abridged)

Comments: 21 pages, submitted to MNRAS
Subjects: **Cosmology and Extragalactic Astrophysics (astro-ph.CO)**
Cite as: **arXiv:1107.5046v1 [astro-ph.CO]**

## Submission history

From: Jeremy Tinker [view email]
**[v1]** Mon, 25 Jul 2011 20:00:04 GMT (432kb)

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