Abstract
We present a measurement of the spatial clustering of 870-μm selected submillimeter galaxies (SMGs) at 1 < z < 3. Using data from the Laboca EDCPS Submm Survey (LESS), we employ a novel technique to measure the cross-correlation between SMGs and galaxies, using full the full probability distributions for photometric redshifts of the galaxies. From the observed projected two-point correlation function we derive the linear bias and characteristic dark matter halo masses for the SMGs. We detect clustering in the cross-correlation between SMGs and galaxies at the 4σ level. We show that SMGs at 1 < z < 3 are indeed strongly clustered and reside in dark matter halos of mass ~a few x 10^{12} h^{-1} Mpc, very similar to the typical halos for optical quasars. This represents the most precise measurement to date of the clustering of ~850 SMGs. We detect the cross-correlation between SMGs and galaxies, using full the full ECDFS Submm Survey (LESS), we employ a novel technique to measure

3. Cross-correlation method and results
To determine the real-space SMG-galaxy cross-correlation, we employ the method of Myers et al. (2009), as implemented recently by Hickox et al. (2011) for quasars in the Boötes field. We compute the projected cross-correlation function w_{p}(R), taking into account the likelihood t_i (see right) that each SMG and galaxy are associated in redshift space. The projected correlation function is then given by (Myers et al. 2009):

\[ \frac{w_{p}(R)}{D_{SMG}} = N_{SMG} \int_{R}^{\infty} \frac{d\chi}{\chi} \rho(R, \chi) \]

where

\[ \rho(R, \chi) = \frac{1}{\sigma_{R,d}(R)} \sum_{i,j} \delta(R_{ij}, \chi) \]

and σ_{R,d} and D_{SMG} are the number of quasar-galaxy and quasar-random pairs, respectively.

4. Halo masses and evolution
Having obtained b_{D_{SMG}}, we can estimate M_{halo} for the SMGs using the relation between linear bias and halo mass of Sheth et al. (2001). We obtain a halo mass for the SMGs of log M_{halo} [h^{-1} Mpc] = 12.8 ± 0.3. This is consistent with previous measurements of the clustering of quasars selected in the optical (e.g., Croom et al. 2005, Myers et al. 2006, da Angela et al. 2008, Ross et al. 2009) and mid-infrared (Hickox et al. 2011). The clustering is also consistent with luminous Herschel sources (Cox et al. 2010) and is stronger than for fainter far-IR emitters (Amblard et al. 2011). These results are consistent with the idea that powerful star-forming activity may be part of an evolutionary sequence that also includes rapid black hole growth (e.g., Sanders et al. 1988, Hopkins et al. 2008), and suggest that SMGs are indeed the progenitors of today’s massive red sequence galaxies. In the future, by combining these measurements with estimates of the space density of SMGs it will be possible to determine the lifetimes of powerful starbursts and further understand their role in the evolution of massive galaxies.

References
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