

Old Monsters

Ben Hoyle, Raul Jimenez, Licia Verde (2011, +in prep), & Shaun Hotchkiss et al (2011a,b) ICC-UB IEEC Uni Barcelona, Uni Helsinki.

Observations of $>M$ $z>1$ clusters

Jimenez & Verde 2009 showed how non-Gaussianity (f_{nl}) can boost the expected abundance of XMMJ2235. [Note re-detected by XCS]

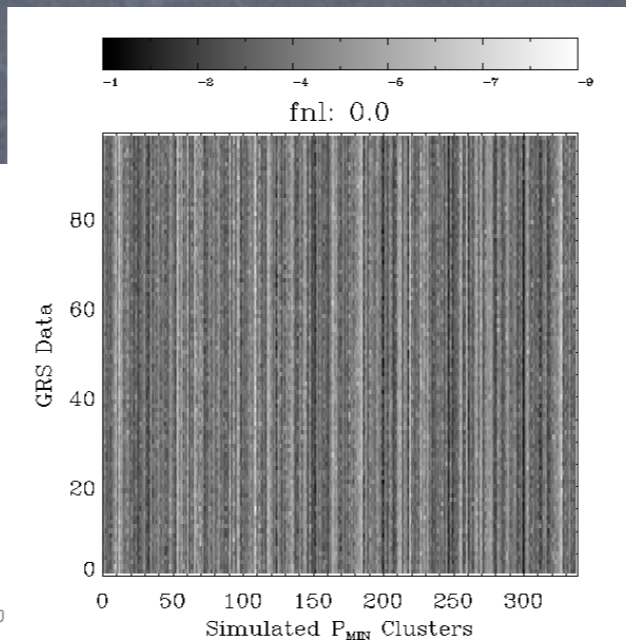
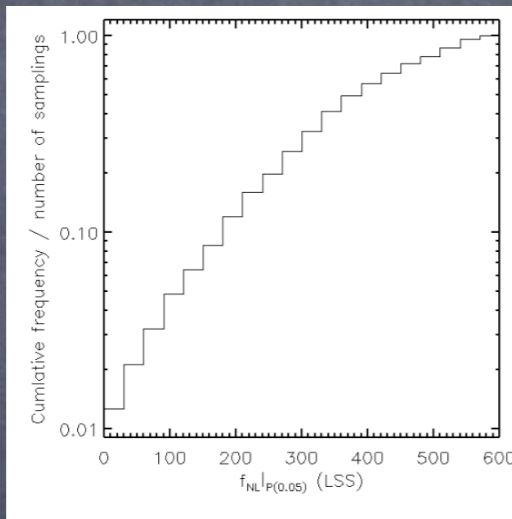


Selection function woes

Hotchkiss 2011 compared the observed clusters with simulations and found that if the observed clusters, were the "least Probable" (LP) clusters, then they did not present any tension with WMAP7 LCDM. However, if they were a random sample, they still caused tension.

Tension with LCDM

Hoyle et al 2011 had a 'first stab' at calculating the tension of multiple 14 [now 23] $z>1$, massive clusters. They found tension can be removed by: $f_{nl}>135$; or $\sigma_8 = 0.9$; or $M = M^*(1-1.5*\sigma_M)$



2d KS test

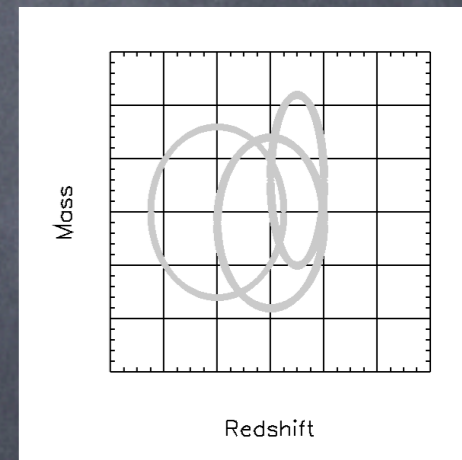
The 2-D KS test determines if two 2d data sets are drawn from the same parent population. We Poisson sample from the theoretical mass function, and compare the resulting LP clusters with each other (varying WMAP7 cosmology) and with the data. We find the simulated LP clusters are consistent with each other ($P=0.2$) but not with the data ($P=0.001$) (figure above) shows the $\log(P)$ between LP simulations and mass error marginalized observed clusters.

Difference maps

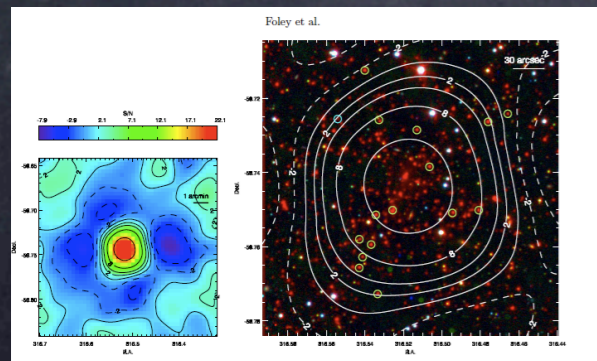
With difference maps, we can perform model selection, or place upper or lower bounds on parameters if the selection function is incomplete, or for complete samples (with understood selection functions) place upper and lower limits on cosmological parameters.

$$\chi^2 = \sum_{i=1}^N \left(\frac{f_{C,i} - A_i}{\sigma A_i} \right)^2$$

We pixelize the (M,z) plane, calculating the expected abundance in each Pixel A_i , and error on the theoretical abundance σ_{A_i} by sampling WMAP7 priors. We then calculate the fraction f_C of each cluster which sits above pixel i . This naturally incorporates the theoretical and observational uncertainties, and the Eddington bias.



Foley et al 2009, Jee et al 2011



Results:

Tension remains, f_{nl} still a contender. See Hoyle et al in prep 2011 for details

