Dark matter maps reveal cosmic scaffolding:

This paper deals with the nature and structure of Dark-matter in galaxies and in clusters. I chose this because I wanted to know more about the nature of Dark-matter and MODE theory is far to complicated for me to understand at this point.

At the beginning of the article they dive into what data they used and on discuss noise and other possible short comings. They use data from HST and COSMOS to measure the shape of half a million distant galaxies. With this they are able to recreate the distribution of intervening mass that is projected along our line of sight. They go on to talk about noise, instrumental, and systematic effects which is given by a “B-Mode”. The B-mode is “a form of ultrasonic medical tomography in which a two-dimensional picture is formed by scanning the line-of-sight propagation path and monitoring the position and direction of the path.” They expect all the effects to zero out and assume a Gaussian noise distribution.

Now authors describe gravitational lensing. This description includes the fact that gravitational lensing doesn’t really work like 1/R^2. This means that they can not use galaxies that are extremely close or far away so this limits them to a small sample size between certain redshifts. So the foreground galaxies are scaled and weighed (I think this is just an estimation) as a function of redshift. This allows them to compare distribution of Dark-matter and of baryonic matter in galaxies and clusters. They seem to be able to subtract the baryonic matter from the galaxy clusters by approximations of galaxy density, stars, and the concentration of hot gas observed by x-rays from the XMM-Newton satellite.

Finally we get into the data and results they have taken. They describe the peaks found in figure 2 and in 3, 2 being a simple plot and 3 being a topological map. In figure 3, which shows a galaxy cluster at .73, they use X-rays to highlight the cluster’s core. It can be seen that the cluster is still growing; as if it was gravitationally relaxed the mass would be far less than what it actually was measured to. So by this they say that there exists an extended dark matter halo around this cluster. Subsequently they also go into possible errors.

It is seen that the distribution of Dark-matter and baryons is the same on large scales. They use a linear regression correlation for lensing masses. The map (fig 3) shows over dense regions of matter that are too weak to create x-ray emissions. The filaments have collapsed but the clusters are sill in the process of collapsing. Again they mention some source or error by noise.

They now take a look at figure 4 which is more topological maps of Dark-matter in clusters. Because the different galaxies are separated by a redshift and so actually by time we can visualize the time dependent growth of the Dark-matter distribution. They talk about more error in the lensing analysis. From all this they are able to create a three dimensional model of the dark-matter distribution in the cluster from slices and filaments. I feel the main point of that section can be summed up in its last line “The evolution of this distribution is driven by the battle between gravitational collapse and the accelerating expansion of the universe”.

They now compare their lensing data to n-body simulations of Cold Dark Matter and find that the resemble one another. I guess they bring this point up to show some validity to there data. The independent probes of large-scale structure are consistent with their finding. The distribution of mass and weak lensing affects show correlation between observations and theories.

The next section basically deals with how they took measurements of their data and how they where able to mitigate some of the errors. There seems to be a lot that could have gone wrong with their data. The three main things they talk about are bolded, Mass reconstruction, Charge Transfer Efficiency correction, and Photometric redshift Measurement. Some of the important things they bring up are shear field, the edge effects of the conversion, E- mode convergence, HST-observations of weak lensing, and Bayesian template-fitting method which is used to estimate the redshift. They assume that the degeneracy is not symmetric and there is possible error in the redshift estimation. All of this really only works well with galaxies between .4 and 1.5 redshift.