LANIAKEA IN A COSMOLOGICAL CONTEXT

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Laniakea, nuestro supercúmulo local, fue definido a partir de observaciones recientes flujos cósmicos. En este trabajo presentamos un estudio sobre simulaciones de N-cuerpos con el fin de establecer la significancia de Laniakea en un contexto cosmológico. Encontramos que supercúmulos similares en tamaño y estructura a Laniakea son poco comunes en un contexto cosmológico amplio.

Laniakea, our local supercluster, was defined by recent observationa of the local cosmic flow. In this work we present a study on large cosmological N-body simulations aimed at establishing the significance of Laniakea in a cosmological context. We find that superclusters similar in size and structure to Laniakea are relatively uncommon on a broader cosmological context.

Tully et al. (2014) defined our home supercluster, Laniakea, as a region region where the peculiar velocity flows converge. Laniakea is found to be contained in a 160 Mpc diameter sphere.

We use a method to find superclusters in dark matter N-body simulations and test it in a simulation of boxsize 350 Mpc.

We base our method on the analysis of the eigenvalues λ_1, λ_2 and λ_3 of the velocity shear tensor $\Sigma_{\alpha\beta} = -\frac{1}{2H_0}\left(\frac{\partial v_\alpha}{\partial x_\beta} + \frac{\partial v_\beta}{\partial x_\alpha}\right)$ (Hoffman et al. 2012).

From these eigenvalues we compute the fractional anisotropy (FA):

$$FA = \frac{1}{\sqrt{3}}\sqrt{\frac{\left((\lambda_1-\lambda_3)^2 + (\lambda_2-\lambda_3)^2 + (\lambda_1-\lambda_2)^2\right)}{\lambda_1^2+\lambda_2^2+\lambda_3^2}}, \quad (1)$$

which tells us whether a local collapse/expansion is anisotropic (FA=1) or isotropic (FA=0).

We find regions with a negative velocity divergence below a certain threshold of fractional anisotropy. Figure 1 shows the number of superclusters with a given volumne. Different curves correspond to different parameters in our supercluster finding method. The first result is that large volume superclusters are robust to changes in the algorithm.

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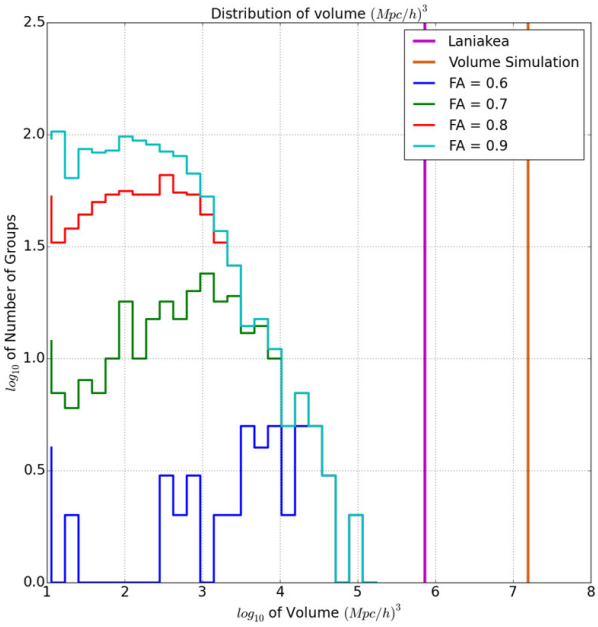

Fig. 1. Abundances of superclusters with different volumes for different parameters in our algorithm.

The main result is that Laniakea is atypically larger than the superclusters in our simulation.

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