

LANIAKEA IN A COSMOLOGICAL CONTEXT

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Laniakea, our local supercluster, was defined by recent observations 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 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):

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

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 volume. Different curves correspond to different parameters in our supercluster finding method. The first result is that large volume

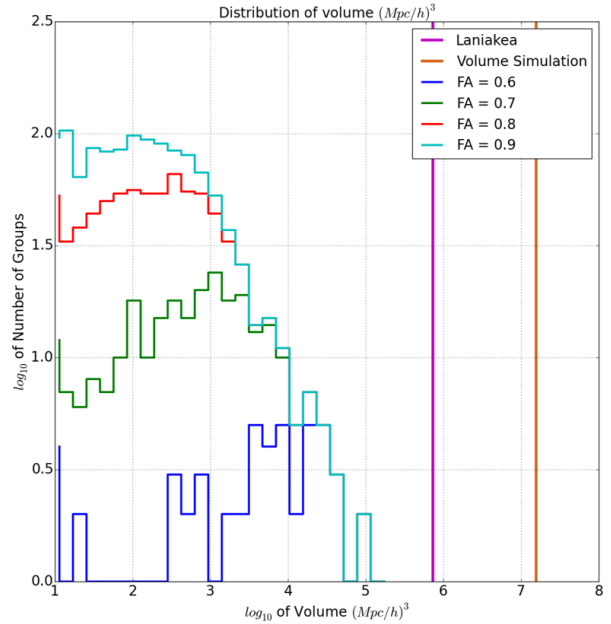


Fig. 1. Abundances of superclusters with different volumes for different parameters in our algorithm.

superclusters are robust to changes in the algorithm. The main result is that Laniakea is atypically larger than the superclusters in our simulation.

REFERENCES

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 Hoffman, Y., Metuki, O., Yepes, G., et al. 2012, *MNRAS*, 425, 2049

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