LANIAKEA IN A COSMOLOGICAL CONTEXT

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A partir de observaciones del flujo cósmico local se ha definido nuestro supercúmulo local, Laniakea. 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.

Recent observations used local cosmic flow information to define our local supercluster, Laniakea. 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. defined our home supercluster, Laniakea, as the region where the peculiar velocity flows converge. Laniakea is found to be contained in a 160 Mpc/h diameter sphere containing a very dense region called the Great Attractor.

We designed a method to find superclusters in dark matter N-body simulations and tested our method in a simulation of boxsize 250 Mpc/h. We based our method on the analysis of the eigenvalues λ_1, λ_2 and λ_3 of the velocity shear tensor $\Sigma_{\alpha\beta} = -\frac{1}{2H_0}\left(\frac{\partial v_\alpha}{\partial x_\beta} + \frac{\partial v_\beta}{\partial x_\alpha}\right)$.

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 if a collapse or 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 summarizes our results. Namely, Laniakea is atypically larger than the detected superclusters and our method is robust as the largest regions are detected independently of the FA thresholds and modifying the grid size in the interpolation do not influence our results.

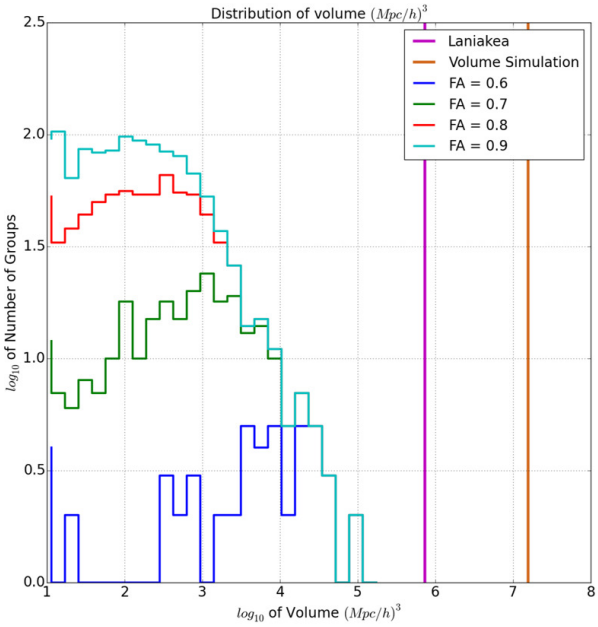

Fig. 1. Distributions of volumes for different seed FA thresholds.

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