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A β-Skeleton LSS Void Finder
Week 07
Beta-Skeleton Repo. & Running in the Cluster.

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TO-DO LIST

Tasks for the week:

- Create a new repo with the light version of Xiao-Dong Li's LSSCode.
- Calculate 1-Skeleton over 125 spherical catalogs (from Abacus Plank Simulation).
- Find volume and triaxial parameters of present voids.
- Find and Compare Void abundance (by volume) with references.
- Take a rest.

1. THE HACKINGLSSCODE REPOSITORY

I have checked the Xiao-Dong Li's repository LSSCodes (hereafter as XDL). It has many features to do hard statistics over LSS catalogs like two and three point correlation functions, β-Skeleton calculator, redshift corrections (using supposed different cosmologies), just for name few of them.

The code was written in Fortran90, once is compiled has one executable binary file for each statistical feature. The β-Skeleton is of particular interest for my thesis and ongoing research at the Astroandes Group. So I create a light version of the original code that only calculates the β-skeleton without the other features.

This version can be compiled using the gnu compiler **gfortran** instead the privative compiler **ifort**. It works on the Uniandes HPC Magnus cluster. The url of the "lightwight" version of the code is available at: https://github.com/flgomezc/HackingLSSCode

2. CALCULATE 1-SKELETON FOR 125 SHPERICAL ABACUS CATALOGS

Once having the β-skeleton calculator installed on the Magnus Cluster, I wrote a python main program to download the catalogs from the repo, create the Random Catalog using the proportion 2:1 (two random particles per halo point).

The whole process (download + calculations) takes $\sim$ 34 minutes, almost 1000 times faster tha using NGL. With NGL it would have taken $\sim$ 24 days, 4.5 hours per catalog over 125 catalogs.

3. FIND VOLUME AND TRIAXIAL PARAMETERS OF EXISTING VOIDS

Ongoing. An issue happend with the previous algorithm because of the output format of XDL: the β-Skeleton index has not repeated connections. The β-Skeleton NGL index lists the connection for each point in the dataset. NGL index is a twice larger than XDL index.

This issue makes the algorithm identify voids made of a single particle. By the algoritm definition that is not possible. The bug was fixed by extending the XDL β-Skel index with the permuted columns.

Once this problem was solved, some huge voids appeared in the "Catalog 0". (the same where previos NGL calculations where performed).

I have been thinking about using a higher β value (maybe $\beta = 2$?) or returnig to the ratio 1:1 between random points and observed points.

4. FIND AND COMPARE VOID ABUNDANCE GRAPH WITH REFERENCES

Some references where found. The Void Volume Abundance graph is not ready, I have not finished yet the volume calculator. About the references, there is not an standar scale among them.

https://arxiv.org/abs/1902.04585 Abundances from simulaions. $z = 0, 0.5, 1.0$ & 1.5

https://arxiv.org/abs/1812.05532 Observational Abundances from SDSS. $0.02 < z < 0.3$

https://arxiv.org/abs/1807.02938 Abundances from simulations. $z = 0, 1.0, 2.2$ and others.

https://arxiv.org/abs/1710.01730 Abudances from sumulations. $z = 0.0, 0.5$

5. TAKE A REST

Ongoing.