PRELIMINARY WORK WITH ILLUSTRIS-3 (Z=0)

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0.1 Introduction

The task given to me was to play around with the data provided on the Illustris/TNG website and do some exercises.
I chose to work with the Illustris-3 (at z=0) data since it was relatively smaller and size and I could download it to my local machine and work accordingly.
I have used some of the example scripts provided on the Illustris site to help me with working with the hdf5 files. Using them as a template, I understood data collection from hdf5 files and how efficiently the format stores the data.
I also used an application called "HDFView" which helped me easily see the stored attributes and fields for the various files (Halo Catalogs, Group Catalogs, etc).
I also looked up the Documentation of both the data as well as the Example Scripts to go about understanding what each field means and how to extract contents out of it.

0.2 Completed Exercises

0.2.1 Exercise 0A

Exercise: Histograms of all entries in halo catalogs by datasets (some datasets)

The Histograms I got were (using the groups_135.hdf5):

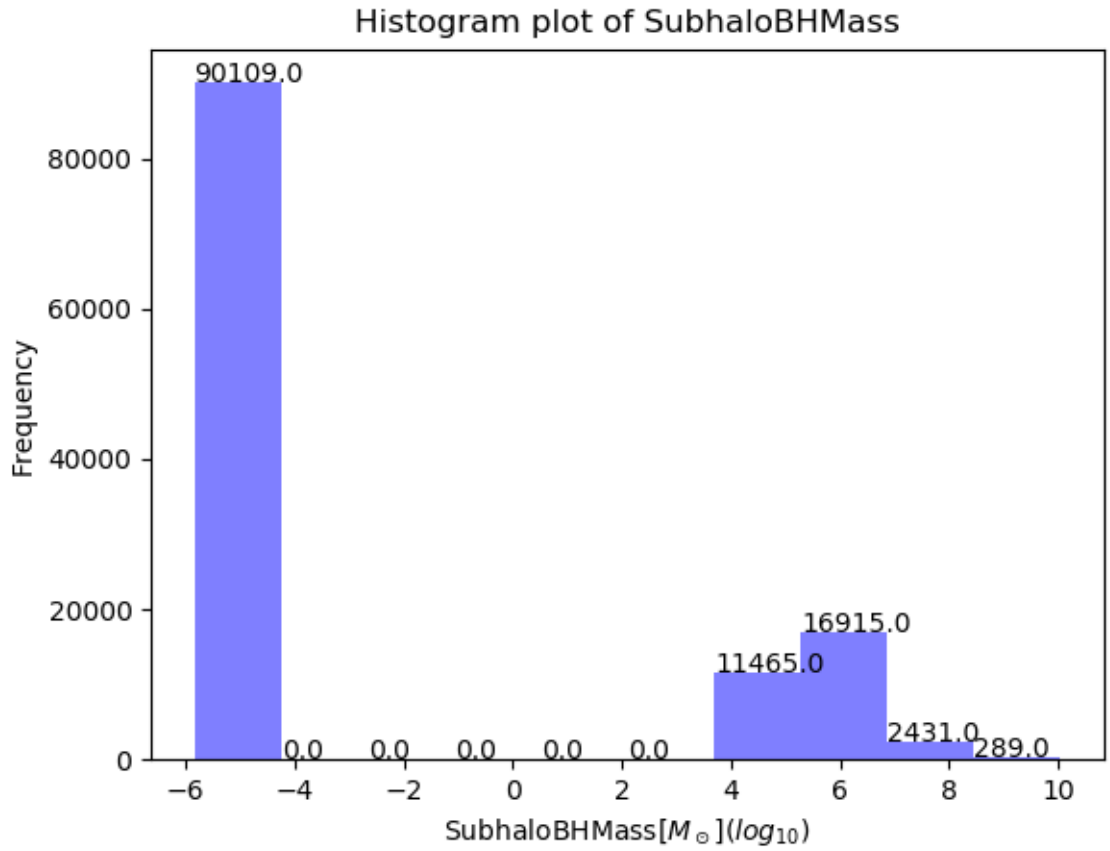


Figure 1: Histogram of Subhalo Black Hole Mass divided over 10 bins (with frequency count written over each bar and log10 taken before binning)

As can be seen, for most of the cases, the frequency is extremely high for small mass values, but there are a few outliers with extremely high mass.

(The code doesn't immediately work for "Type" based fields like SubhaloLenType since they don't have float input. One will have to one hot-encode them before plotting)

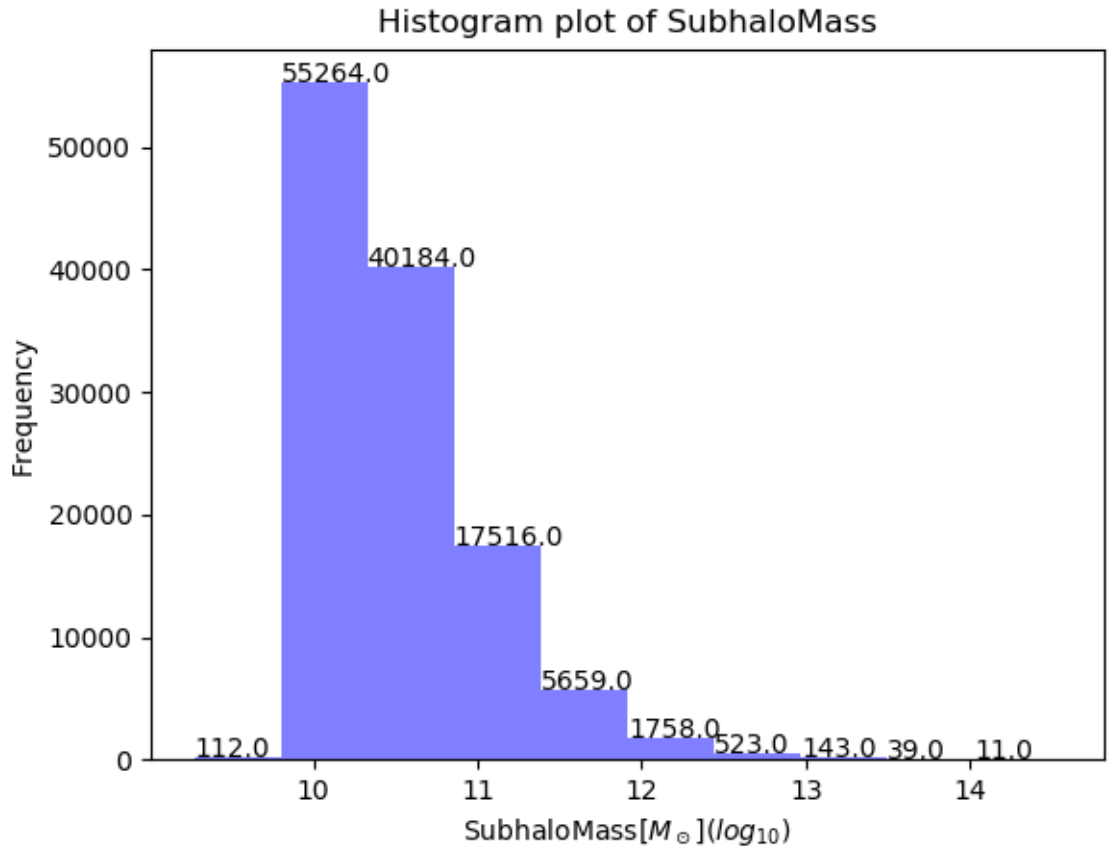


Figure 2: Histogram of Subhalo Mass divided over 10 bins (with frequency count written over each bar and log10 taken before binning)

0.2.2 Exercise 0B

Exercise: Histograms of all entries in snapshots by datasets (some datasets)

The Histograms I got were (using the snap_135.0.hdf5):

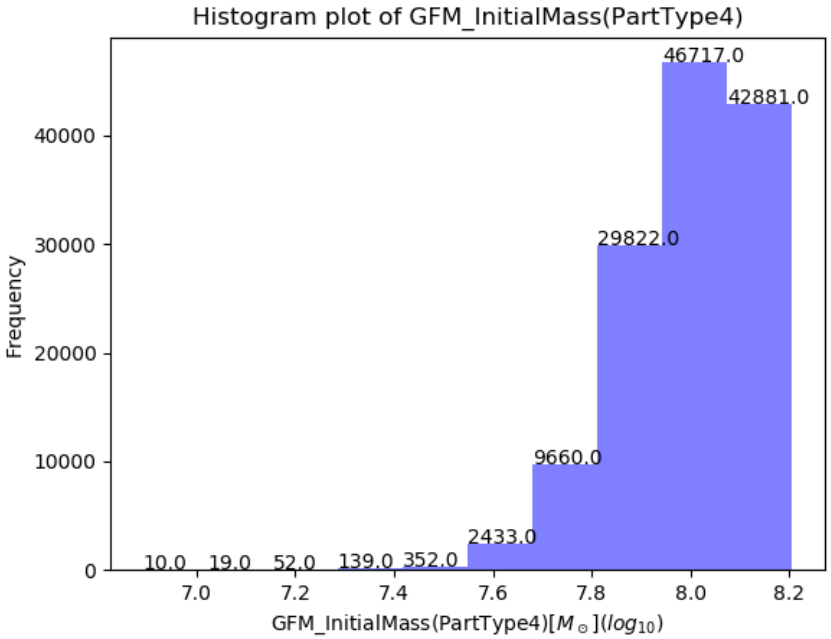
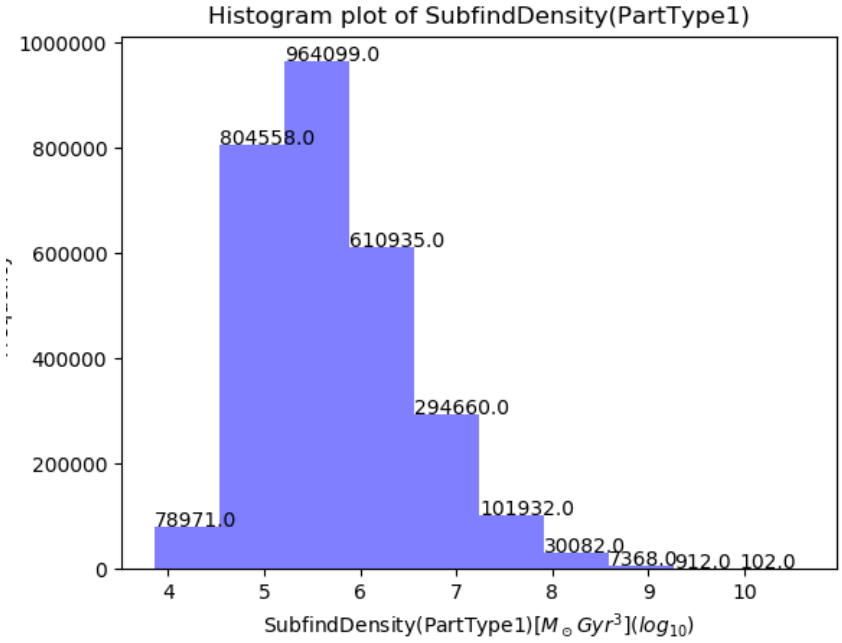


Figure 3: Histogram of GFM Initial Mass (Star Type) divided over 10 bins (with frequency count written over each bar and log10 taken before binning)



e.png

Figure 4: Histogram of SubFind Density (Dark Matter Type) divided over 10 bins (with frequency count written over each bar and log10 taken before binning)

0.2.3 Exercise 0C

Exercise: Plot the positions in 2D of all haloes and of all particles in the sim (only for Illustris-3), one chunk at the time

The Plot I got (using the groups_135.hdf5 and snap_135.0.hdf5):

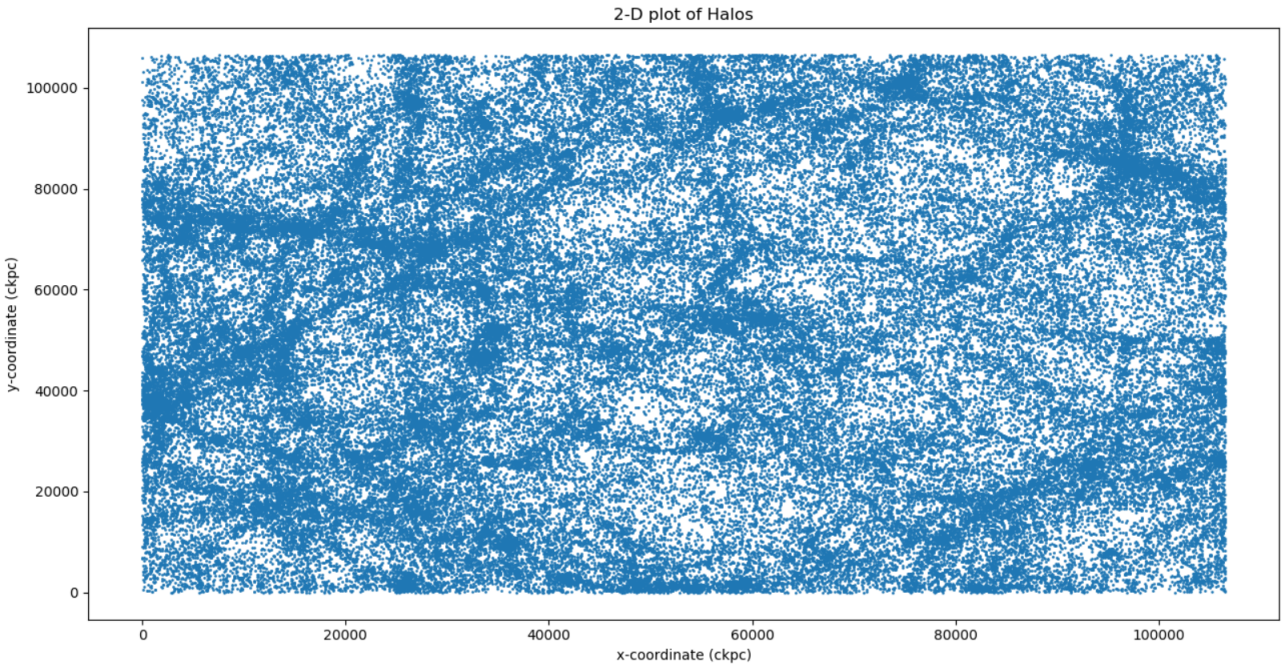


Figure 5: 2D Plot of Halo locations (Centre of Mass)

In the second plot (next page), the FoF implementation can be easily seen as we only see the particles clustered in only some locations. For the complete image, one will have to process all the Snapshot files and superimpose on top of the other (here, I have only taken one).

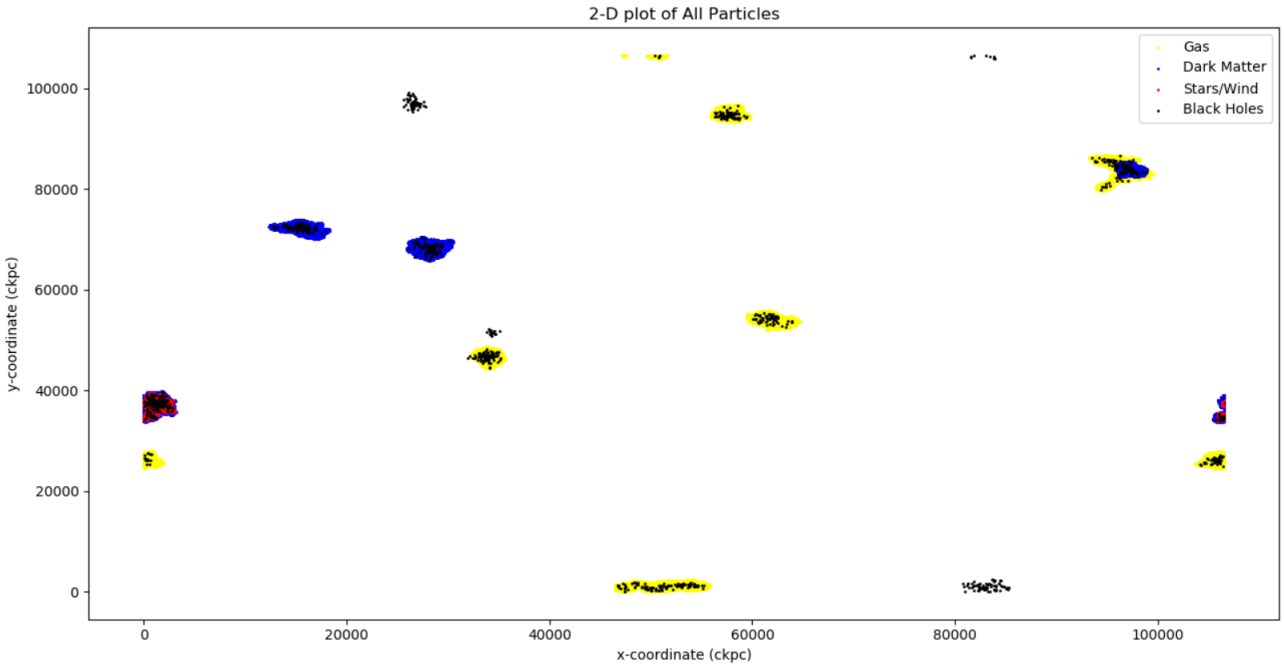


Figure 6: 2D Plot of all particles