research assignment 2

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1 Introduction

The MW and M31 Halo Major remnant as well as dark matter halo evolution density relates to the known fact that eventually the milky way and Andromeda galaxies will eventually merge together and result in a new galaxy. The idea of this new galaxy poses many questions of interest and projected models show that it has potential to differ from its parent galaxies in ways that may help us understand dark matter more.

Using data from the dark matter within both of these galaxies we are able to simulate the real local group allowing us to see if it has a similar history to that of the known disc galaxies MW and M31 [3] .Along with looking at the history of the galaxies we can also look forward to the future of when the two galaxies merge to see what kind of galaxy will form from the remnants and relate this to galaxies that are currently known.

Our current understanding of the halo major remnant is only what we can gather from simulations as the merger hasn't occurred yet. What we have been able to gather is that it will result in the formation of a new galaxy in its wake, as for the density profile of the halo that is up for debate.

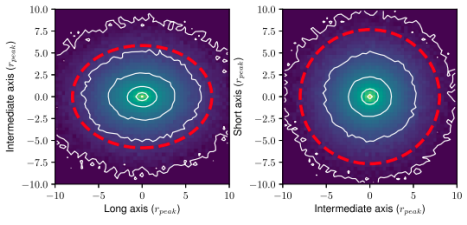

Figure 6. Projected isodensity contours (white lines) of the halo remnant. The measured shape ratio is shown as by the red dashed line.

Figure 1: A projection of dark matter halo density profile [2]

The questions being asked about this merger are how will the merge affect the density profile of the newly formed galaxy and how will the merger affect the shape of the dark matter halo. Again the merge density has projections but none are truly set in stone.

2 Proposal

My plan for this project is to attempt to answer what kind of density profile the child galaxy will have as it seems to be a topic of interest as well as what finding what shape the dark matter will take on whether that be spheroidal or ellipsoid

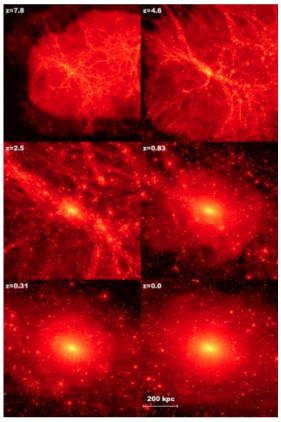

Figure 2: dark matter density maps [1], I hope to be able to reproduce something similar to this although most likely in lower quality

I plan on doing this by attempting to create my own simulation of the galaxy merger and developing a plot that will show the locations of the dark matter as well as the density. In order to find the 3 dimensional shape of the dark matter I plan to make a plot of it in multiple coordinate systems, [x,y],[x,z],[y,z], and etcetera in order to grasp the shape as python isn't able to my knowledge to produce 3 dimensional plots.

I believe that the child galaxy will possess a lower dark matter density profile as I believe that most of the dark matter will be lost in the merger due to the violent and chaotic nature of the merger causing lots of mass to be lost in space. I also believe that the final shape for the dark matter halo will be that of a ellipsoid due to how the clash of the galaxies will cause a sort of elongation.

References

[1] Jürg Diemand and Ben Moore. The structure and evolution of cold dark matter halos. *Advanced Science Letters*, 4(2):297–310, 2011.

[2] Nicole E. Drakos, James E. Taylor, Anael Berrouet, Aaron S. G. Robotham, and Chris Power. Major mergers between dark matter haloes - I. Predictions for size, shape, and spin. , 487(1):993–1007, July 2019.

[3] Jaime E. Forero-Romero, Yehuda Hoffman, Gustavo Yepes, Stefan Gottlöber, Robert Piontek, Anatoly Klypin, and Matthias Steinmetz. The dark matter assembly of the Local Group in constrained cosmological simulations of a cold dark matter universe. *Monthly Notices of the Royal Astronomical Society*, 417(2):1434–1443, 10 2011.