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Reseach Assignment 4

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1. INTRODUCTION

The merger between the milky way and M31 galaxies are a point of high interest for astronomers and physicists alike. The reason for this is due to the fact that the remnant left behind by the merger will give key insights into the evolution of the dark matter halo that exists around both galaxies as well as information on how the density profile will change with time. —

The merger between the two galaxies is an important scientific event due to its information it can provide on the field of dark matter which we know very little about. Dark matter is an extremely important part of our universe making up over 80 percent of all matter content so any information we can gather about the topic is a benefit to our understanding of galaxies and the universe altogether. This merger will also provide us with insight into how dark matter interacts with other similar particles. Along with all of this, the remnant left behind presents a perfect opportunity to study the birth of a new galaxy. —

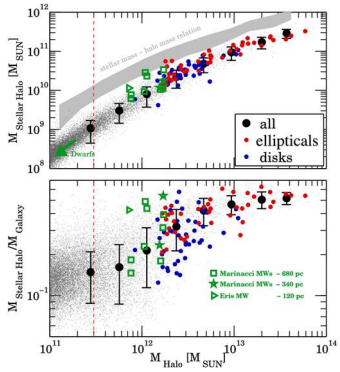

Figure 1. Stellar halo mass vs Dark matter halo mass

As far as what we know know about the dark halo merger and dark matter altogether is as previously stated not much. From research done performing simulations of dark matter halos sampling over 5000 galaxies we find that a trend emerges stating that more massive dark matter halos lead to shallower and less massive stellar halos(1). —

With dark matter being so abundant yet so difficult to study there are many questions that still need to be answered. One that has peaked my interest is the evolution of the dark matter halo after the two galaxies have merged, specifically the density profile.

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It is up for debate how the density profile will change as the two galaxies merge, whether it will be drastic or negligible as well as if the dark matter halo will become less or more dense, these are the questions I hope to answer. —

2. PROJECT

In this paper we will explore the evolution of the dark matter halo of the milky way and M31 galaxies as well as looking at the aspects of the dark matter halo of the remnant galaxy that is left behind after these two galaxies combine. We will specifically focus on comparing the current mass profiles of both galaxies to the mass profile after both galaxies merge around 6.5 Gyr. —

With the results we will be exploring we will be able to explore the idea of how dark matter evolves and interacts with other dark matter as we will be simulating the combination of the two dark matter halos of the two galaxies. —

Answering this question is important due to our lack of knowledge on how dark matter operates as well as the evolution of galaxies. By looking at how the dark matter halos interact and fuse together will help add to our knowledge about dark matter as well as seeing how the mass profile of a galaxy merger remnant evolves over time. —

3. METHODOLOGY

In order to obtain the data we are using simulated data of both the milky way and M33 galaxies in the future approximately 6.5 Gyr. This value for time was chosen as it is the earliest point when the center of masses of both galaxies is at a relative minimum, from there we step forward roughly 1.5 Gyr with each iteration. —

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4. RESULTS

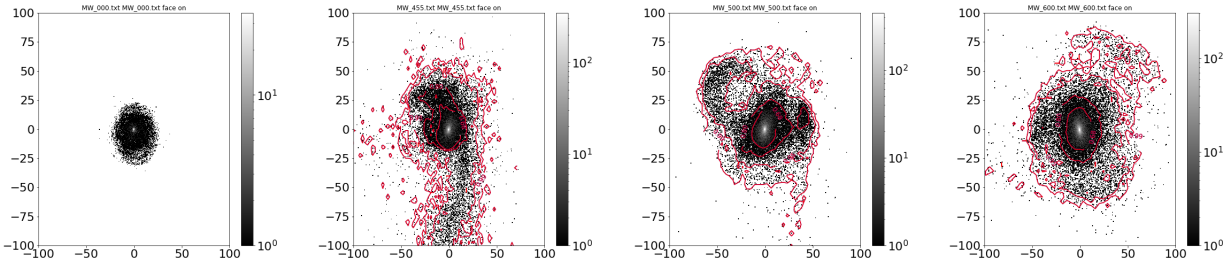

Figure 2. Here we have shape of the dark matter particles at a time of 0 Gyr (top left) 6.5 Gyr (top right) 7.1 Gyr (bottom left) and 8.5 Gyr (bottom Right)

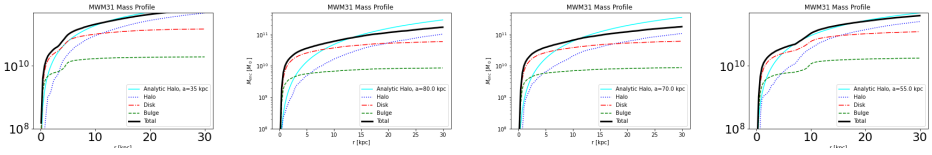

Figure 3. mass profile at 0 ,6.5 , 7.1 , and 8.5 Gyr

From these two figures generated through the use of histograms in python along with calculating the average center of mass between the two galaxies we are clearly able to the change in shape of dark matter halo remnant over time. —

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5. REFERENCES

REFERENCES

[1]Annalisa Pillepich, Mark Vogelsberger, Alis Deason, Vicente Rodriguez-Gomez, Shy Genel, Dylan Nelson, Paul Torrey, Laura V. Sales, Federico Marinacci, Volker Springel, Debora Sijacki, and Lars Hernquist. Halo mass and assembly history exposed in the faint outskirts: the stellar and dark matter haloes of Illustris galaxies. *Monthly Notices of the Royal Astronomical Society*, 444(1):237–249, 08 2014.