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Tidal evolution of M33's dark matter halo

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1. INTRODUCTION

A majority of a galaxies dark matter is known to reside in its outer halo, otherwise known as the Dark Matter Halo. Due to the uneven spread of mass in the galaxy, differences in gravity are experienced across the galaxy. This leads to tidal forces that shift the galaxies mass around, including its dark matter, which also has an affect on these tidal forces. This force changes with time due to the shifting mass, so we can observe how it changes by observing the change in the galaxies mass profile.

Understanding dark matters affect on tidal evolution helps us to understand galaxy evolution. Since dark matter exerts a force on objects around it, it influences the evolution of galaxies.

M33 in particular is a Satellite Galaxy of Andromeda, meaning it orbits around another Andromeda. M33 is also a Spiral Galaxy, which is defined as a galaxy where stars and matter form in clusters shaped like arms that form spirals around the center bulge.

2. THIS PROJECT

3. METHODOLOGY

An N-body simulation is a simulation that approximates the physical behavior of astronomical objects such as galaxies based on various parameters, such as gravity and mass.

To approach this problem, I'll be looking at the density profile of M33 as several different snapshots so I can see how it changes with time. To calculate density profile at each snapshot, I'll calculate the mass at several different radii, and divide by volume. I'll do this for multiple snapshots so I can observe any changes in the density profiles. Since there are so many snapshots to look at, I'll likely look at more critical events in the lifespan of M33, such as when it reaches apogee or perigee. Afterwards, I'll fit it to a Hernquist profile to see how they compare.

In order to calculate mass profiles, I'll need to calculate the galaxies center of mass, which can be done by looping through a reduced radius. I'll calculate the mass profile by looping through several radii and adding the masses that match the criteria to an array. I'll make a loop that calculates the mass profiles for each snapshot.

I'll make a plot that takes a number of critical points in the galaxies lifespan and plots several evolving density profiles. Each line will represent a different radius, and the plot will graph density vs time. That way, I can see how each profile evolves differently with time.