

# Research Assignment 1

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## 1 Research Topic

The research topic that I would like to focus on for the final project in this course is question four (4) which explores the MW/M31 dark matter halo major merger remnant. Throughout the course, I have become very interested in the discussion of dark matter and how it affects galaxies and their evolution. Although my project will focus on question four, I would also like to add information from question three (3) which explores the stellar remnant as well as the formation of elliptical galaxies, and question six (6) which explores the galaxy-halo connection pre-collision and post-collision. As I am most interested in the dark matter involved in the collision, my project will focus on question four, but I think connecting this information to the stellar remnant and therefore the galaxy-halo connection will allow me to explore all the topics that I am interested in.

## 2 Specific Questions for Research

1. Is there any rotation/what is the evolution of the angular momentum of the dark matter halo? What is the velocity dispersion profile of the remnant? How does this compare to the stellar remnant in the bulge/disk or in other words, what fraction of the angular momentum is in the disk and halo pre-collision and post-collision? How does this compare to the original dark matter profile of each galaxy?

**Explanation:** I want to explore the nature of the dark matter within the MW/M31 galaxy remnant and compare the results with the known profiles of the individual galaxies before the merger. I also think it would be interesting to compare the post-collision dark matter profile to the post-collision stellar profile. Because the merger will result in the formation of an elliptical galaxy, I would like to analyze whether there is rotation with either the dark or stellar matter. If rotation is present, is there rotation in opposing directions, or is one direction "stronger" than the other?

2. What is the shape of the dark matter distribution of the remnant? Is it triaxial, oblate, prolate, etc.? How does it compare to the shapes of the dark matter distributions of the galaxies pre-collision (including M33)? Does the stellar distribution have a similar shape? How do they vary with radius?

**Explanation:** I think that comparing the shape of the dark matter distribution in the post-collision galaxy to the individual galaxies would be very interesting. Does the post-collision galaxy reflect one galaxy more than the other and what does that say about each of the dark matter halos pre-collision? In addition, I would want to compare these distributions to the stellar distribution to see if there are any similarities. Does the stellar distribution mimic one galaxy while the dark matter distribution mimics another?

3. Does the merged remnant follow the stellar mass-halo mass relation? (extra)

**Explanation:** I think that I already have a lot of information to explore with the first two questions but I would like to answer this question as well, potentially in the "discussion" section of my paper. If I am able, I think it would add to the final thoughts of my project and help to consolidate the information found in the previous two questions.