MW+M31 Stellar Remnant: Stellar disk particle distribution/morphology

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1 Introduction

1.1 Topic

I will be determining the distribution of the stellar material remnant from the MW-M31 merger event.This involves studying the distribution and morphology of the stellar material from MW and M31 individually and as the new combined system.

1.2 Why it matters to galactic evolution

This is an important topic in galactic evolution, since it will give better understanding as to how the stars interact during a merger. We can study whether the stars from the constituent galaxies mix or remain separate. This will also potentially give information on the formation of larger elliptical galaxies, by modeling the shape of the distribution. By measuring the location of the disk material at time slices, it might be possible to model the structure and kinematics of the tail or bridge materials.

1.3 Current Understanding

Based on our current understanding of the remnants of galactic mergers, it is possible that S0 galaxies can form from merger events. The resultant S0 galaxies match a Sersic profile with an index of $1 < n < 2$. These mergers can occur in as little as 3Gyr. There are two main merger variants; minor and major mergers. A minor merger occurs when one of the galaxies is significantly larger than the other, while a major merger occurs when both of the galaxies are roughly the same size. In a minor merger, the larger galaxy will usually completely consume the smaller one, while the galaxies merge into a new composite galaxy. The merger of the Milky Way and M31 will be a major merger. It has been shown that minor mergers may preserve the disk/bulge structure of the progenitor galaxies. These properties are not likely to be preserved during a major merger event. Two common features that are likely to be seen in major merger events are bridges and tails. A bridge is a stream of stars linking the merging galaxies, while tails are streams of stars trailing a galaxy.

1.4 Current Issues/Question

Some of the open issues in the field of galactic mergers involve the study of the tails and bridges between merging galaxies. This is due to the fact that our current telescopes are not sensitive enough to capture details of these structures. Because we cannot determine the properties of these structures, it is not easy to determine their origins. They may have been formed from galactic mergers or a disrupted satellite. Another issue comes from assuming that disk instability arises before mergers. This causes the quasar luminosity history is shifted to a time earlier than what is observed.

1.5 Time evolution of minor merger simulation (Stellar and Gaseous Material)

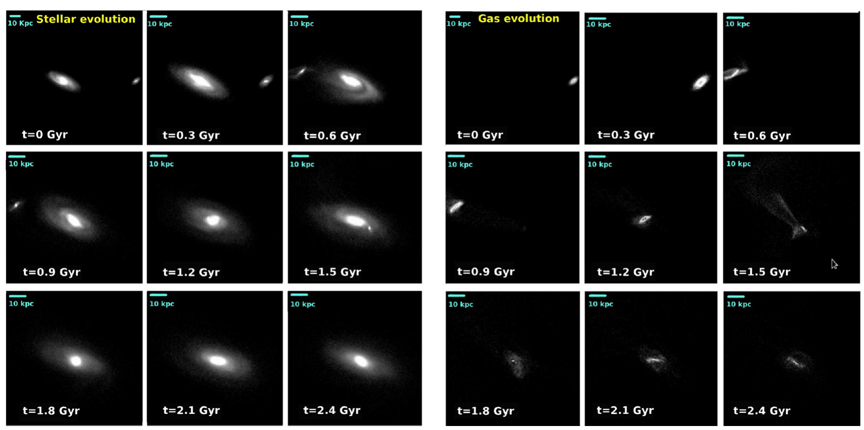

Figure 1: Time evolution of the stellar and gaseous material

2 Proposal

2.1 Specific Questions

I will specifically be looking at the final stellar density profile for the new merged galaxy. I will be determining whether or not the new stellar density is well modeled by a Sersic profile and how well it agrees with the predictions for elliptical galaxies.

2.2 Approach

I plan on modeling the merger as a time dependent process, where at each time slice the distribution of the stellar disk particles for each galaxy is measured. I will run this for the amount of time calculated in HW6, roughly 4.5Gyr. At each slice of time, I will calculate the gravitational impact that the total mass; disk, halo, and bulge, of each galaxy will have on the other. In order to compare the result to a Sersic profile, I plan on looking at how the central surface brightness compares to the mass distribution. By comparing the central mass to the central surface brightness it should be possible to determine how well the merged galaxy matches with a Sersic profile. In order to determine whether the resultant galaxy agrees with predictions of known elliptical galaxies, I will look at real world values for the Sersic index of known galaxies.

2.3 Flowchart

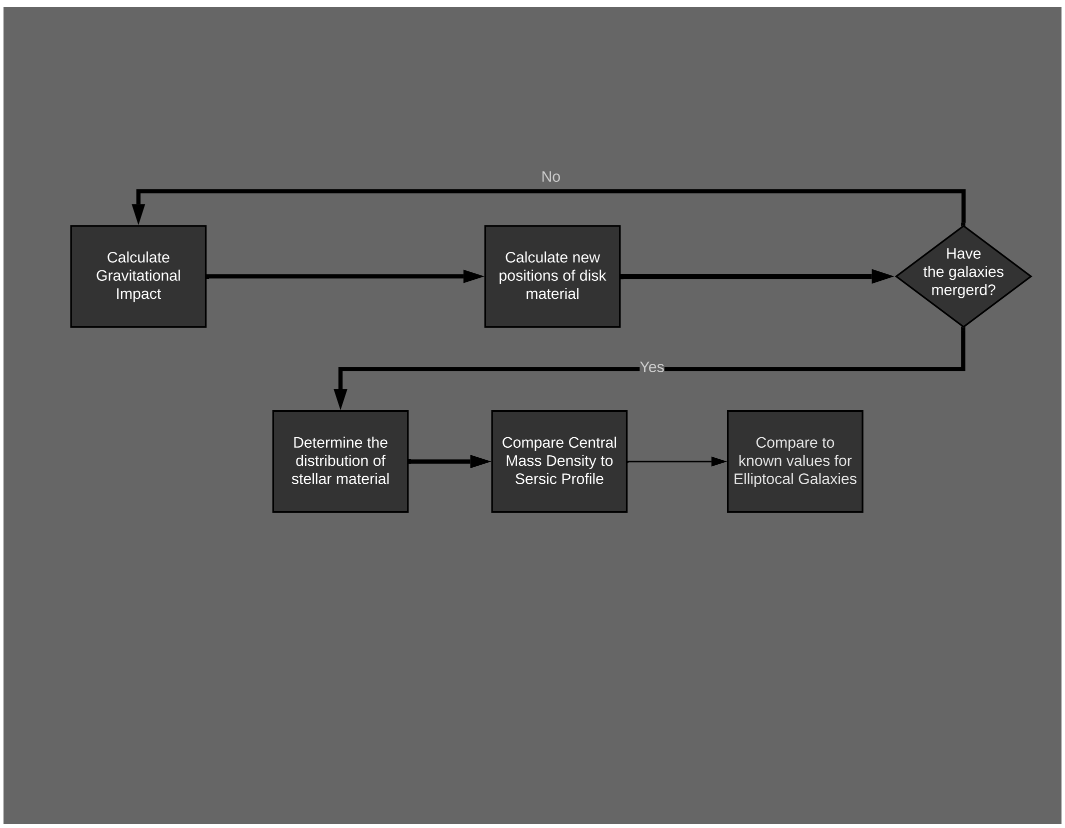

Figure 2: Proposed Work Flowchart

2.4 Hypothesis

I expect the merged galaxy to eventually settle into a Sersic profile mass distribution. This may not happen during the merger, but given the continued dynamics, the system should settle into a stable S0 with a Sersic profile with an index of $1 < n < 2$. Since both MW and M31 are roughly the same mass, I expect that the disk material of each galaxy to be evenly distributed throughout the new merged galaxy. []

References

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