Part 5: Analysis

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Due: April 3rd, 2020

1 Plot

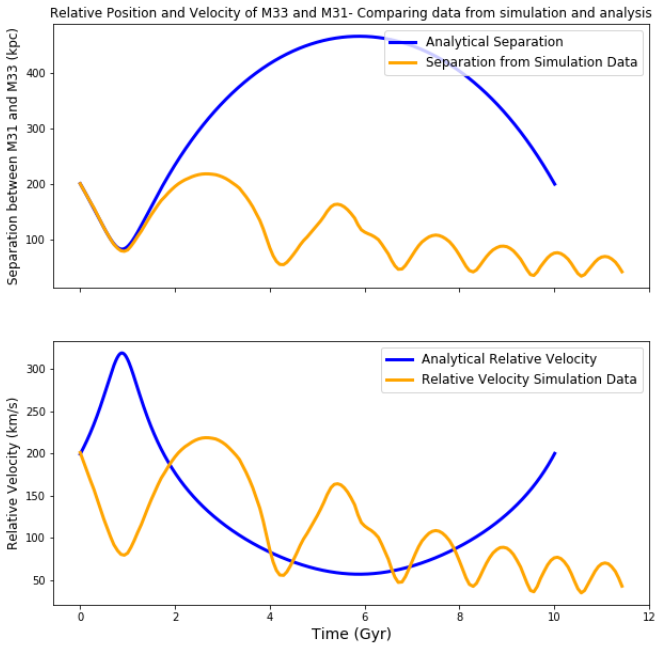

Figure 1: Plot from Homework 7. The blue lines show the relative separation and velocity of M33 compared to M31, using an analytical approach with the position and velocity. The orange lines show the same thing, but uses the position and velocity simulation data that we had used in Homework 6

2 Questions

2. How do the plots compare?

The plots are clearly very different from each other. For the position and velocity, our analytical plot predicts that M33 is going around M31 in one large orbit rather than the several smaller ones. With the scale of the orbit now as well, we are unable to tell if in the analytical plot that we see the same decay that we saw in the M33-M31 simulation from Homework 6

3. What missing physics could make the difference?

We are missing the mass of the Milky Way in this scenario. This can make a big difference, because we would be introducing another body into this simulation, so it would be more of a three-body solution rather than a 2 body problem like we have done. The Milky Way's mass is nearly identical to M31, so it is not negligible in this case- especially when they merge.

4. The MW is missing in these calculations. How might you include its effects?

As mentioned above, the Milky Way's mass should be taken into account for this problem. At the beginning of the simulation, M33 is much further away from the Milky Way compared to M31, so the force the MW is exerting on M33 isn't as substantial. However, once the major merger starts to occur, it would be better to add the mass of the MW to M31 in order to make it more realistic in the analytic equations to the mass that M33 is actually starting to orbit around.