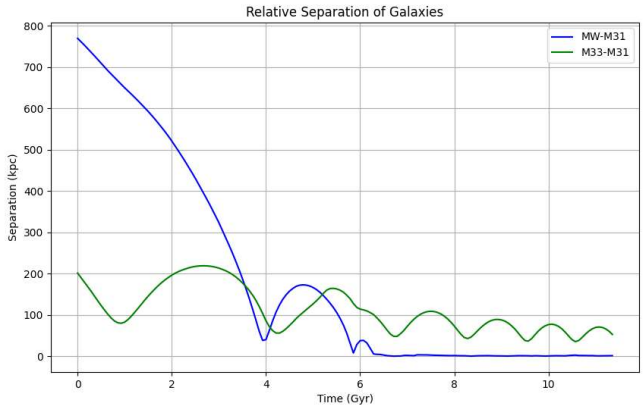
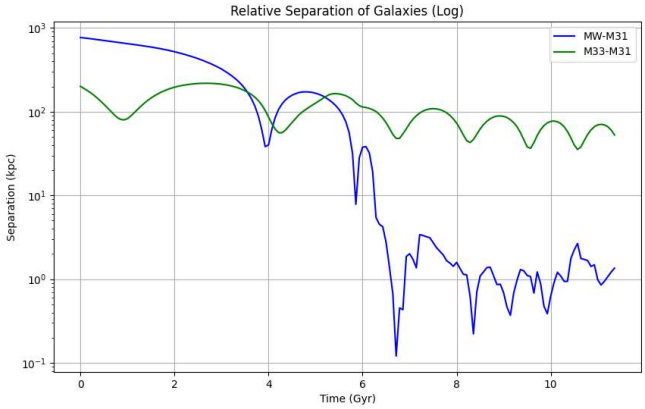
HW6

Tuesday, February 25, 2025 1:05 PM

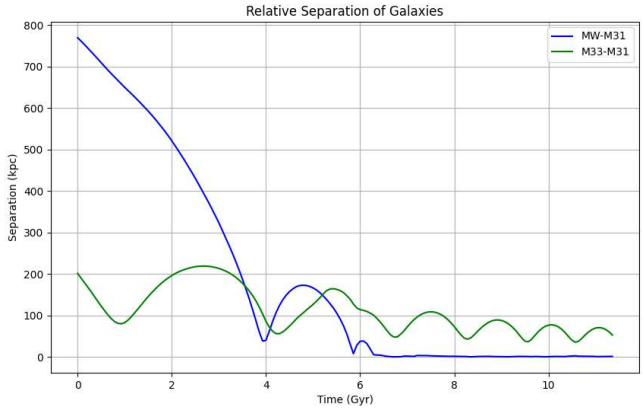
1. How many close encounters will the MW and M31 experience in the future?

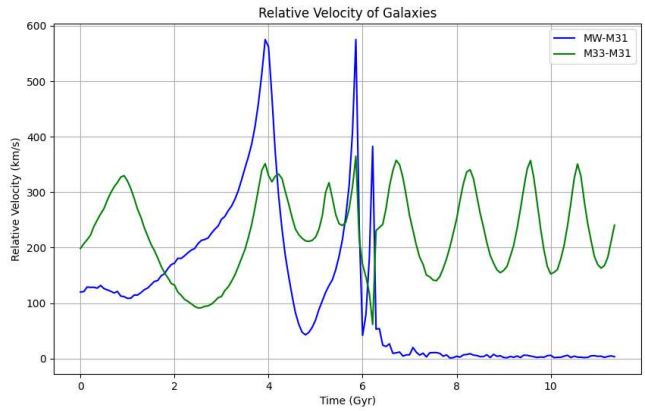




We follow the blue line, where 0 or ~10^0 separation means they merge.
There will be 2 close encounters, with the 3rd time merging.

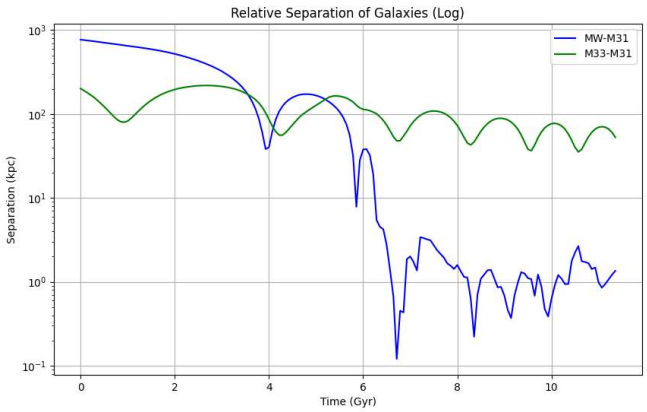
2. How is the time evolution of the separation and relative velocity related?





Let's look at the peaks of each graph. As the distance between the 2 galaxies get closer their velocity speeds up. But after they pass and their distance stretches further apart, the velocity drops as well. This is showing a spring type action between the two galaxies, showing they will eventually merge. The velocity between the two galaxies reaches zero when they merge because they are no longer separated.

3. When do M31 and the MW merge? (you might need to zoom in on the plot - try a log y axis). What happens to M33's orbit when they merge?



We can say that the merger between MW and M31 happens when the separation is nearest 0 or 1. This happens around 6.8 Gyr. We can see that M33's gets tighter spirals.

There is a strange dip of M33-M31's path when MW-M31 is in its lasts spring away, which means the center of mass of the MW merging galaxies disrupt the position of M33. After that it appears the distance between M33 and M31 becomes closer together, but also goes into an orbital motion like a satellite. The trend appears to steadily get closer, because the orbits are smaller, and the orbits are decreasing in separation. But the linear trend is very gradual, so M33 will act like a satellite for a long time before merging into the MW-M31 merged galaxy.