Part 4: Questions

1. How does the total mass of the MW and M31 compare in this simulation? What galaxy component dominates this total mass?

The masses of the MW and M31 are essentially equal. The component that dominates the total mass is the Halo.

2. How does the stellar mass of the MW and M31 compare? Which galaxy do you expect to be more luminous?

M31 has a larger stellar mass so we expect M31 to be more luminous.

3. How does the total dark matter mass of MW and M31 compare in this simulation (ratio)? Is this surprising, given their difference in stellar mass?

$\frac{MW_{DM}}{M31_{DM}} = 1.02811,$ The Milky way has more dark matter mass than M31. No this is not surprising, since the stellar mass is lower, the dark matter must carry more sway on the galaxy's mass.

4. What is the ratio of stellar mass to total mass for each galaxy (i.e. the Baryon fraction)? In the Universe, Ωb/Ωm ~16% of all mass is locked up in baryons (gas & stars) vs. dark matter. How does this ratio compare to the baryon fraction you computed for each galaxy? Given that the total gas mass in the disks of these galaxies is negligible compared to the stellar mass, any ideas for why the universal baryon fraction might differ from that in these galaxies?

MW: 0.063

M31: 0.067

M33: 0.046

Universe: 0.16

The Baryon fraction for the universe is just less than three times the ratio of MW and M31 but almost 4 times as large as M33. The universe baryon fraction may be larger than these galaxies because of large scale structures like galaxy structures that are binded by dark matter out in the vast universe

	Galaxy Name	Halo Mass [10^12 SolMasses]	Disk Mass [10^12 SolMasses]	Bulge Mass [10^12 SolMasses]	Total [10^12 SolMasses]	f_bar	Local Group Mass [10^12 SolMasses]
0	MW	1.975	0.075	0.01	2.060	0.063	4.316
1	M31	1.921	0.120	0.019	2.060	0.067	NA
2	M33	0.187	0.009	NA	0.196	0.046	NA