ASTR4000B HW3

Laura Johanna Mack

February 2025

Galaxy Name	Halo Mass ($M_\odot$x 10^{12})	Disk Mass ($M_\odot$x10^{12})	Bulge Mass ($M_\odot$x10^{12})	Total ($M_\odot$x10^{12})	Mass fraction
Milky Way	1.975	0.075	0.01	2.06	0.041
M31	1.921	0.12	0.019	2.06	0.067
M33	0.187	0.009	0	0.196	0.046
Total	408.241	20.43	2.906	431.57	0.05

1. The Milky Way and M31 have the same total mass. In both cases, the Halo mass dominates.

2. MW has a stellar mass of 0.085 10^{12} x $M_\odot$ and M31 has a stellar mass of 0.139 10^{12}x$M_\odot$. M31 has a larger stellar mass than the Milky Way, so I would expect M31 to be more luminous.

3. The baryon mass fraction of the Milky Way and M31 is 0.041 and 0.067, respectively. Of the galaxies investigated, M31 has the highest mass fraction. The fact that it is 2% larger than the other galaxies is somewhat surprising. Especially given the fact that the Milky Way and M33 have mass fractions that are so similar.

4. The universal baryon fraction of 16% is much larger than the total 5% present in the simulation. For the Milky Way, with its mass fraction of 4.1% and M33 with 4.6% this disparity is greater than for M31 with its larger mass fraction of 6.7%. To avoid this disparity, there must be some amount of baryons present in the universe outside of galaxies. This is the intergalactic medium.