

1. Both MW and M31 are equal in total mass. The largest component is the halo in each galaxy.
2. Since the total mass for each galaxy is equal, the galaxy with a smaller comparative halo mass will have the larger stellar mass which is M31. I expect M31 to be luminous since it overall has more stellar mass than MW.
3. MW has larger dark matter mass than M31 and this is not surprising given their difference in stellar mass as the total galaxy mass for MW and M31 is equal. Since MW has less stellar mass, it needs more dark matter to account for the gravitational effects of dark matter to hold MW together when compared to M31.
4. $MW = 0.041 = 4.1\%$
 $M31 = 0.067 = 6.7\%$
 $M33 = 0.046 = 4.6\%$

All of the galaxies have a smaller value of baryon fraction to total mass compared to the 16% for the whole universe. The galaxies need way more dark matter to hold together a galaxy compared to the universe where there is less dark matter outside of galaxies. With this, there are more lone stars and planets that are not in galaxies.