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Feb 6th,2020

Homework3

3. Mass Break Down of the Local Group (standard value $10^{12} M_{\odot}$)

Galaxy	Type1(Halo)	Type2(Disk)	Type3(Bulge)	Total mass	Stellar mass	fbar
MW	1.975	0.075	0.01	2.06	0.085	0.085/2.06
M31	1.921	0.12	0.019	2.06	0.139	0.139/2.06
M33	0.187	0.009	0.0	0.196	0.009	0.009/0.196

Halo Mass (type(1)) of MW: 1.975 solMass
 Disk Mass (type(2)) of MW: 0.075 solMass
 Bulge Mass (type(3)) of MW: 0.01 solMass
 Total Mass of MW: 2.06 solMass
 Halo Mass (type(1)) of M31: 1.921 solMass
 Halo Mass (type(2)) of M31: 0.12 solMass
 Halo Mass (type(3)) of M31: 0.019 solMass
 Total Mass of M31: 2.06 solMass
 Halo Mass (type(1)) of M33: 0.187 solMass
 Halo Mass (type(2)) of M33: 0.009 solMass
 Halo Mass (type(3)) of M33: 0.0 solMass
 Total Mass of M33: 0.196 solMass

(result by computer processing)

4. Questions

1. From the table above, we can say that the Total mass of MW and M31 is similar. And from the percentage of the total mass, the percentage of Halo Mass of MW is 95.87%; the percentage of the Halo Mass of M31 is 93.25%. So this shows us that Halo Mass dominates the total Mass.

2. For MW, stellar mass is $0.085 \times 10^{12} M_{\odot}$, stellar mass of M31 is $0.139 \times 10^{12} M_{\odot}$.

Therefore the stellar mass of M31 is larger than MW, then M31 is more luminous. The mass of bulge is larger, which means there are more supermassive astronomical objects in bulge. So as we learned from Astr 400A, the evolution of stellar is like a battle between gravitational force and degeneracy/radiation/gas pressure. So as the bulge is larger, it means more energy radiative away. Thus M31 is more luminous than MW.

3. Dark Matter Halo mass of MW is 1.975, and for M31 is 1.921. The ratio of M31/MW for dark matter halo is $1.921/1.975 = 0.9726$. This is not surprising, maybe there are less small galaxies or globular clusters or clusters of stars in the dark halo for M31. Even the galaxy has the same mass, that does not mean they should have exactly the same structures.

4. The baryon fraction of MW is about 4.1%, and for M31 is about 6.7%. Both of them are less than 16%. Well, I guess this happens because we count too much mass from dark halo.