ASTR 400B Homework 3

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1 Questions

1. The total mass of the Milky Way and M31 are nearly equivalent, and both masses are largely dominated by the dark matter in the halo.

2. The stellar mass of M31 is about 50% higher than the stellar mass of the Milky Way. Given that luminosity is only a function of stellar mass, and not dark matter mass, we expect the luminosity of M31 to be higher than that of the Milky Way.

3. The dark matter halo mass of the Milky Way is relatively higher than that of M31! This is definitely surprising, because I would have expected that larger stellar mass would correlate with larger halo mass.

4. The baryonic fractions of these galaxies are considerably lower than the universal baryonic fraction. As mass contribution from gas is negligible, the only explanation I can think of for this discrepancy is that the baryonic mass fraction of galaxies has evolved over the life of the universe, resulting in a wide range of baryonic fractions in galaxies from different epochs.

2 Table

Galaxy Name	Halo Mass $1 \times 10^{12}\,M_\odot$	Disk Mass $1 \times 10^{12}\,M_\odot$	Bulge Mass $1 \times 10^{12}\,M_\odot$	Total Mass $1 \times 10^{12}\,M_\odot$	Baryonic Fraction
Milky Way	1.975	0.075	0.01	2.06	0.0413
M31	1.921	0.12	0.019	2.06	0.0675
M33	0.187	0.009	0.0	0.196	0.0459
Local Group	4.083	0.204	0.029	4.316	0.054