Homework - 4 Astronomy 400 B

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1 Questions

1.What is the COM position (in kpc) and velocity (in km/s) vector for the MW, M31 and M33 at Snapshot 0 using Disk Particles only (use 0.1 kpc as the tolerance so we can have the same answers to compare)? In practice, disk particles work the best for COM determination. Recall that the MW COM should be close to the origin of the coordinate system (0,0,0).

For Milky Way, (i) the distance vector is $(-2.07, 2.95, -1.45)$ kpc and the magnitude is 3.885 kpc, and (ii) the velocity vector is $(0.94, 6.32, -1.35)$ km/s and the magnitude is 6.531 km/s. For M31, (i) the distance vector is $(-377.66, 611.43, -284.64)$ kpc and the magnitude is 772.977 kpc, and (ii) the velocity vector is $(72.85, -72.14, 49.0)$ km/s and the magnitude is 113.632 km/s. Lastly, for M33, (i) the distance vector is $(-476.22, 491.44, -412.4)$ kpc and the magnitude is 798.982 kpc, and (ii) the velocity vector is $(44.42, 101.78, 142.23)$ km/s and the magnitude is 180.449 km/s.

2. What is the magnitude of the current separation (in kpc) and velocity (in km/s) between the MW and M31? Round your answers to three decimal places. From class, you already know what the relative separation and velocity should roughly be (Lecture2 Handouts; Jan 16).

The magnitude of the current separation between Milky Way and M31 galaxy is 769.098 kpc. The magnitude of the relative velocity between these two galaxies is 117.738 km/s. Both values agree with the ones from the lecture.

3. What is the magnitude of the current separation (in kpc) and velocity (in km/s) between M33 and M31? Round your answers to three decimal places.

The magnitude of the current separation between M33 and M31 galaxy is 201.083 kpc. The magnitude of the relative velocity between these two galaxies is 199.370 km/s.

4. Given that M31 and the MW are about to merge, why is the iterative process to determine the COM is important?
The iterative process to determine the COM for both galaxies is important to analyze the merger as by iteratively calculating the center of mass positions, we will be able to ignore the tidally ripped stars - those stars which are far far away from the concentrated part of the galaxy and thus not play an important role in the analysis of the merger.