Physics 167 – Astronomy

Homework #8

Chapter 15

1. The Large Magellanic Cloud orbits the Milky Way at a distance of roughly 160,000 light-years from the galactic center and a velocity of about 300 km/s. Use these values in the orbital velocity formula to estimate the Milky Way's mass within 160,000 light-years from the center.

2. Suppose you observed a star orbiting the galactic center at a speed of 1000 km/s in a circular orbit with a radius of 20 light-days. Calculate the mass of the object that the star was orbiting.

3. Stars in the outskirts of a globular cluster are typically about 50 light-years from the cluster's center, which they orbit at speeds of about 10 km/s. Use these data to calculate the mass of a typical globular cluster.

4. Suppose you discovered a star made purely of hydrogen and helium. How old do you think it would be? Explain.

5. The gravitational pull of an isolated globular cluster is rather weak—a single supernova explosion can blow all the interstellar gas out of a globular cluster. How might this fact relate to observations indicating that stars ceased to form in globular clusters long ago? How might it relate to the fact that globular clusters are deficient in elements heavier than hydrogen and helium?

6. The average speed of stars in the solar neighborhood relative to the Sun is about 20 km/s. Suppose you discover a star in the solar neighborhood that is moving at a much higher speed relative to the Sun, say, 200 km/s. What kind of orbit does this star probably have around the Milky Way? In what part of the galaxy does it spend most of its time? Explain.