Quadrant I Analysis & Conclusions: Determining a Velocity Curve

You will apply the tangent method for determining the velocity of the MWG at your given galactic longitude. As a class we will determine a velocity curve for the MWG, which is a graph of the galactic velocity versus distance from the galactic center.

Procedure

1. From the HI spectrum at the galactic longitude angle your group was given, use the Doppler effect to determine the speed of the most blue-shifted hydrogen detected.
2. Use the **tangent method** to determine the assumed distance of this fastest moving hydrogen from the GC.

Results

1. Show your work for the calculations done as instructed in the Procedure above.
2. Include a printed graph of the HI spectrum at the angle your group was given. Staple it to this sheet.
3. Share your results in the spreadsheet shared in Google Docs.
4. Record the class data in the table below.

Galactic Longitude	Distance from GC (kpc)	Relative Speed (km/s)	Rotational Speed (km/s)
0^o			
20^o			
20^o			
30^o			
40^o			
45^o			
50^o			
60^o			
70^o			
80^o			
90^o			

5. Plot a graph of galactic velocity vs. distance from GC, and staple it to this sheet.

Interpretation

1. According to the Velocity vs. Distance from GC graph, how does the rotational speed of the MWG depend on the distance from the GC?

2. What model of the galaxy might these results fit? To answer this, complete the following:

   a. Kepler Model

   Assume most of the mass of the galaxy, M_G, is concentrated at its center. This model mirrors the model of our solar system, where the sun is at the center. Apply your knowledge of orbital motion in this model to determine the $v(r)$ function, and sketch a graph illustrating this function.

   $v(r)$ =

   On the graph include a sketch of the $v(r)$ function from the horn data the class collected.



   b. Spherical Galaxy with Uniform Mass Density Model

   Assume that the galaxy is spherical and its mass, M_G, is distributed uniformly. The gravitational force behaves the same as the force inside a spherical planet with uniform density. Assume the galaxy has a radius R_G. Apply your knowledge of the gravitational force in this model to determine the $v(r)$ function, and sketch a graph illustrating this function.

   $v(r)$ =

   On the graph include a sketch of the $v(r)$ function from the horn data the class collected.



Conclusion

Based on the models represented above and our experimental results, what can you conclude about the mass distribution of the Milky Way Galaxy? Might there be other models to describe the mass distribution of the galaxy?