Physics 108 – Introduction to Cosmology

Spring 2012 Myers

Homework 6

Please write all your work and answers on separate paper. (You can turn in this page with the questions or not, as you wish). Show all your work on calculations and explain your reasoning whenever you can.

1. The Oort cloud may extend out to as far as 100,000 AU. How far is that in light years?
2. **Gregory's Method:** In 1668 James Gregory proposed that the distances to the stars could be infered directly from their brightness. Brighter stars should be closer, while dimmer stars would be farther away. In modern terminology, he proposed that any star could be used as a "*standard candle*". We can test his idea using data from the textbook. Using the list of the brightest stars in Appendix 13, create a *scatter plot* with the apparent visual magnitude of the star along the x-axis, and the distance to the star in parsecs on the y-axis. You need only use the stars closer than 50 pc, and be sure to use apparent magnitude, not absolute magnitude.
   If Gregory's method works there should be a clear pattern. Do you see such a pattern?

3. **Gregory's Method, adjusted:** The problem with Gregory's method is that stars do not all have the same brightness – some are brighter, some are dimmer. But if we could find a group of stars that all have the same brightness, the method might work. We can try the idea out with the same data, by adjusting the brightness of each star in the list so that it is as if that star is just as bright as the Sun, which has an absolute visual magnitude of +4.8. To do so, create a scatter plot similar to the one in the previous problem, using only those stars closer than 50 pc. For each star compute what we will call the *adjusted visual magnitude* as follows:
   a. Subtract the star's absolute visual magnitude from +4.8, the absolute visual magnitude of the Sun. This measures how much brighter or dimmer this star is compared to the Sun.
   b. Add this difference to the star's apparent visual magnitude, resulting in the "adjusted" visual magnitude. This is the visual magnitude of the star if it had the same absolute magnitude as the Sun.
   c. Add the star to the scatter plot by using the adjusted visual magnitude on the x-axis and the distance to the star in parsecs on the y-axis.

   If this works, there should be a clear pattern. Is there? Explain what it means.