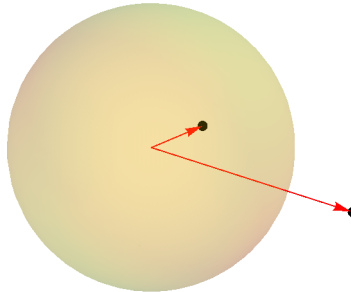


Arvind Borde

AST 10: Homework 9

1. How does the CfA redshift survey determine distances to the galaxies? **Redshifts → velocities → distances.**
2. What have the CfA redshift and Sloan Digital Sky surveys found about the 3D structure of the Universe? **It's "foamy:" galaxies strong along filaments, with huge voids.**
3. What are the differences among the stellar populations of elliptical and spiral galaxies? **Elliptical: older stars. Spiral: mix of ages of stars, with new star formation.**
4. Do observations show that stars in galaxies have higher or lower orbital velocities than indicated by the visible matter? What is the implication of this? **Higher. Suggests missing mass.**
5. What's a QSO? **Quasi-Stellar Object. Extension of quasar class.**
6. Why was the discovery of quasars significant? **Furthest known objects. Appear to have supermassive black holes. Strong energy emission.**
7. Can we watch galaxies evolve and interact in "real time"? If not, how do we know the different stages of galactic behavior? **No. But large spatial distribution shows us young and old galaxies. Also look back in time.**
8. Suppose you have a spherical distribution of matter with a fixed density, as shown below:



The "safe" orbital velocity (so that you neither fall to the center nor spiral out) obeys

$$v \propto \begin{cases} r & \text{inside} \\ \frac{1}{\sqrt{r}} & \text{outside} \end{cases}$$

- a) When you are inside the sphere does the orbital velocity go up or down as r increases? **Up.**
- b) When you are outside the sphere does the orbital velocity go up or down as r increases? **Down.**
- c) Is this consistent with the *expected* rotation curve of galaxies? **Yes.**