Dai? / Leighly?

PROBLEM 5

a. (2pts) Draw a typical velocity rotation curve for a spiral galaxy. What does the observed rotation curve tell us about the matter distribution in spiral galaxies?

b. (3pts) Describe the Tully-Fisher relationship for spiral galaxies and why it is important.

c. (5pts) Assume a spiral galaxy has a mass to light ratio γ. Use the virial theorem to derive an expression for the galaxy's dynamical mass in terms of γ, L, v_c, and R.

$\frac{M_*}{L} = \gamma$

$\frac{1}{2} M_T v_c^2 = + \frac{G M_* M_{DM}}{2R}$

$\gamma L = M_*$

$M_* + DM = M_T$

$a_c = \frac{v_c^2}{r}$

$M_T = \gamma L +$

$L + = \frac{GMm}{2r}$

$a_c = \frac{GM_T}{R^2} = \frac{v_c^2}{R}$

$M_T = \frac{v_c^2 R}{G} = \gamma L + M_{DM}$

$= \frac{v_c^2 R \gamma L}{G \gamma L}$

$\frac{GM^2}{r} = M v_c^2$

$\gamma L = M_*$

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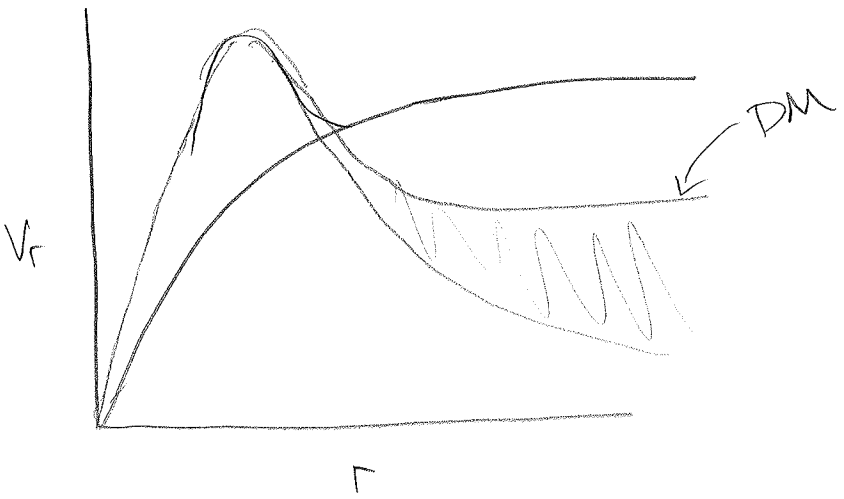
Astro # 5

a)



The flat rotation curves of spiral galaxies at large radii tell us that $\rho \propto \frac{1}{r^2}$
The increasing interior part corresponds to rigid body rotation and $\rho \propto$

b) The Tulley - Fisher relationship describes a relation b/w the maximal rotation velocity and luminosity of a spiral galaxy based on the galaxy's Hubble type. By combining this relationship with other measurement it allows us to estimate the masses and distances to spiral galaxies.

c) $\gamma = \frac{m}{L}$

* Virial Thm states:

$$T = -\frac{1}{2}U$$

$$E = \frac{1}{2}U$$