

Galactic Dynamics AST1420

Problem Set 1

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Due: Tuesday, February 7th 2017, 1pm

Problem 1.1

Calculate the effect of a uniform medium with density $0.1M_{\odot}\text{pc}^{-2}$ (i.e. Dark Matter) on:

- (a) the period of the Earth.
- (b) the period of the Sun orbiting the Milky Way. Assume a circular orbit, $r = 8$ kpc, and a mass of $5 \cdot 10^{10} M_{\odot}$ inside the Sun.
- (c) the period of the LMC orbiting the Milky Way. Assume a circular orbit, $r = 50$ kpc, and also a mass of the Milky Way of $5 \cdot 10^{10} M_{\odot}$.

Problem 1.2

We are looking at a spherical transparent galaxy. One quantity we didn't talk about in the lecture is the luminosity density, $j(r)$. It is measured in units of luminosity per volume and is a function of the position r . Show that the surface brightness $I(R)$ and the luminosity density $j(r)$ are related by

$$I(R) = \int_R^{\infty} \frac{2r j(r)}{\sqrt{r^2 - R^2}} dr$$

Problem 1.3

Invert the relation from 1.2 using Abel's integral equation.