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 $0.1 \text{M}_\odot \text{pc}^{-2}$ (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, $r = 8 \text{kpc}$, and a mass of $5 \cdot 10^{10} \text{M}_\odot$ inside the Sun.  

(c) the period of the LMC orbiting the Milky Way. Assume a circular orbit, $r = 50 \text{kpc}$, and also a mass of the Milky Way of $5 \cdot 10^{10} \text{M}_\odot$.  

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.