homework 3 due Nov

1) Along a line-of-sight directed in the Galactic plane along a Galacticlongitude of $45^{o}$, what is the approximate maximum observed radialvelocity from HI emission and the value of R where this occurs?

2) From S&G : **Problem 4.2** The Carina dwarf spheroidal galaxy has a velocity dispersion σ three times less than that at the center of the globular cluster Ω Centauri, while Carina's core radius is 50 times greater.
Use the virial theorem to showthat Carina is about six times as massive as Ω Centauri and estimate *M*/*L*.

3) From the class notes discuss why study of the galaxies in the local group is important for our understanding of more distant galaxies- what can we learn about stars and their evolution and their IMF from the local group that is hard to learn about more distant objects.
Estimate the capabilities of large ground based telescopes (Keck, VLT, Gemini) to determine the spectra of stars in the local group; e.g. what sort of stars can have reasonable quality spectra measured .
Estimate the capabilities of Hubble to measure the Color-mag diagram in the Local group. How far down the H-R diagram can you go with Hubble.
How far can Hubble obtain a 'reasonable' H-R diagram ; what is the most distant spiral for which Hubble WF3 can obtain a color-magnitude diagram (in the colors of your choice)
To answer the last 3 parts you will need to go find the capabilities of these telescopes. If you have problems doing so, ask me.

4).
(a) Using the Jeans equation, find the integrated mass profile M(r) of a spherical galaxy with surface brightness distribution given by
$I(R) = I_0 / (1 + (R/R_0)^2)$ ,
where $I_0$ is the central surface brightness and $R_0$ is a characteristc radius.
Assume a constant line-of-sight velocity dispersion, $\sigma_p$, and a isotropic velocity distribution.
(b) Plot M(r) in a log-log plot. Comment on the results.
(c) Derive the profile of the mass-to-light ratio, $\gamma(r) = M(r)/L(r)$, and plot it as a function of log r. Comment on the results.

5)
A galaxy has a flat rotation curve, $v(r) = v_c$, with $v_c$ a constant, out to some radius R. Interior to R the dominant contribution to the potential is dark matter, with a spherically symmetric distribution. Outside R, the mass density is zero.
What is the form for the escape velocity from the galaxy as a function of r and R.