Physic 325:Astrophysics. HW 1 Due Wed Oct 25.

In general, I expect you to work problems out from first principles—the goal is to develop the skills of applying your basic physics to astrophysical situations, not to apply random formulas. I expect you to be clear and justify any assumptions you make in working out these problems. I expect you to show all steps. If you look up any quantities, you must provide references.

1a) Plot, with your favorite software (ask me if you need a recommendation), θ, $\tan\theta$, $\sin\theta$ on the same set of axes for values of θ from 0 to 0.2 radians.

b) Quantitatively comment on how good the small angle approximation is over this range of angles.

2.Model the earth's equatorial bulge as a 21 km thick x 21 km wide band of extra material around an otherwise spherical earth. You may assume the material is of density equal to the average density of the earth.

a)Starting from Newton's law of gravity, develop a way to estimate the torque on this bulge due to the differential gravitational attraction on it from the moon.

b)Use the results of a) to find an estimate of the precession frequency of the earth

3.Look up the (average) distance from the earth to the sun.

a)Knowing that the earth orbits the sun in one year, calculate the (average) speed of the earth around the sun.

b)Using the appropriate addition of velocity vectors, develop a first-order estimate of the maximum stellar aberration for star whose position vector is perpendicular to the plane of earth's orbit.

4.Why does the sun move exactly along the ecliptic, but other planets in the solar system only approximately along the ecliptic?

5. Describe in some detail the motion of the moon on the celestial sphere. In particular explore these: Does the moon move …on the ecliptic? …on the celestial equator? …Other?