10/14/2011. **Due:** Friday, Oct. 21, 2011 (in class).

Physics 501: Classical Mechanics

Read: **LL** 25-26, 31-36;

Problems with stars are not for credit and will NOT be graded.

Homework 6

Exercise 1

Estimate quality factors of a church bell and of a simple children's toy bell (nothing fancy, just make an educated guess).

Exercise 2

Calculate the inertia tensor of a molecule consisting of 12 identical atoms of the mass m each forming an icosahedron (the radial size of the icosahedron is R).

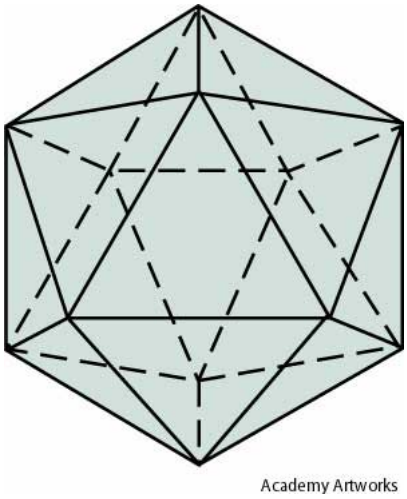

Figure 1: To Exercise 2.

Exercise 3

A solid homogeneous cube occupies the region of space given in some reference frame by $0 \leq x, y, z \leq a$. Calculate the inertia tensor of the cube in this reference frame.

Exercise 4

A solid homogeneous ball of the radius R has a spherical cavity of the radius r with the center at the distance a from the center of the ball. Choose a convenient reference frame and calculate the inertia tensor of this body.

Exercise 5

A neutron star of the mass $M = 3 \times 10^{30}$kg and radius $R = 10$km rotates with the frequency $f = 100$Hz. The star (pulsar) has a magnetic moment and radiates electromagnetic energy with power $P = 3.8 \times 10^{32}$W. Find the rate with which it slows down its rotation. For example, you can find the relative change of the frequency of rotation for the period $\Delta f/f$.

Exercise 6 (JS 8.3)

Calculate the rotation matrix $R(\theta)$ that results from a rotation of θ about the 3 axis followed by another of θ about the 2 axis. Now calculate the result of applying them in the opposite order. Note the difference. Specialize to $\theta = \pi/2$. Find the axes and angles of the resulting $\pi/2$ rotations.