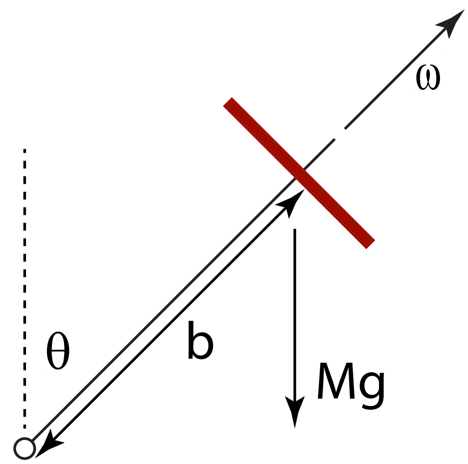
Physics 410 F17 **HW #4**

1) Use Euler's equations to solve for the precession rate of a rapidly spinning gyroscope precessing uniformly (no wobble, also known as no nutation). Use I_3 for the moment along the z axis along the axle.



Beginning with Euler's equations, derive the coupled equations

$$\dot{\omega}_1 + \Omega\omega_2 = N_1 / I_1 \qquad \text{where} \quad \Omega = \frac{(I_3 - I_1)}{I_1}\omega_3$$
$$\dot{\omega}_2 - \Omega\omega_1 = N_2 / I_1$$

And then solve for the precession rate of the gyroscope. (Remember the technique of adding i-times the second to the first equation, as for Focault's pendulum.) Because Euler's equations are in the body frame, the torque is time-varying with angular frequency ω_3. Note that the gyroscope precession rate is very different than the force-free precession rate Ω.

2) Solve the problem of 1) in the precessing frame. The precessing frame is neither the body frame or the fixed frame.

3) Find the frequency of small amplitude oscillations for a thin equilateral triangle suspended from one apex (oscillating in the plane). Use the parallel axis theorem to get the moment of inertia of the triangle.

4) Find the principal moments and principal axes of a cube of mass M and side length b with the origin at one apex.