PHYS 1443 – Section 001
Lecture #15

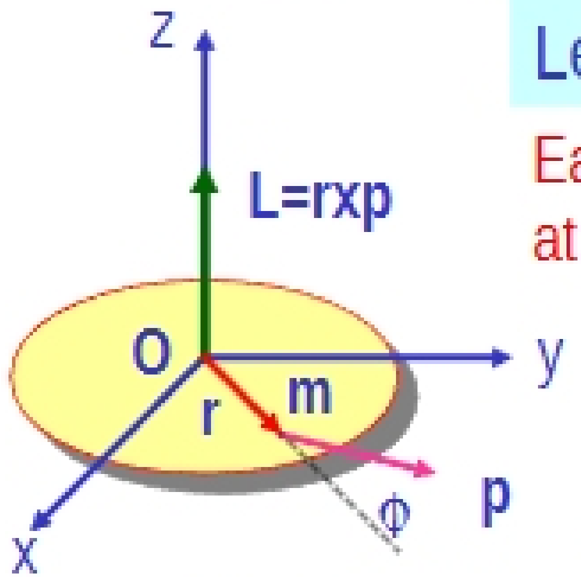
Tuesday, June 27, 2006
Dr. Jaehoon Yu

- Angular Momentum & Its Conservation
- Similarity of Linear and Angular Quantities
- Conditions for Equilibrium
- Mechanical Equilibrium
- How to solve equilibrium problems?
- Elastic properties of solids

Announcements

- Reading assignments
  - CH12 – 7 and 12 – 8
- Last quiz tomorrow
  - Early in the class
  - Covers Ch. 10 – 12
- Final exam
  - Date and time: 8 – 10am, Friday, June 30
  - Location: SH103
  - Covers: Ch 9 – what we cover tomorrow
  - No class this Thursday

Angular Momentum of a Rotating Rigid Body



Let's consider a rigid body rotating about a fixed axis

Each particle of the object rotates in the xy plane about the z-axis at the same angular speed, ω

Magnitude of the angular momentum of a particle of mass m_i about origin O is $m_i v_i r_i$

$$L_i = m_i r_i v_i = m_i r_i^2 \omega$$

Summing over all particle's angular momentum about z axis

$$L_z = \sum_i L_i = \sum_i \left(m_i r_i^2 \omega\right)$$

What do you see?

$$L_z = \sum_i \left(m_i r_i^2\right)\omega = I\omega$$

Since I is constant for a rigid body

$$\frac{dL_z}{dt} = I\frac{d\omega}{dt} = I\alpha$$

α is angular acceleration

Thus the torque-angular momentum relationship becomes

$$\sum \tau_{ext} = \frac{dL_z}{dt} = I\alpha$$

Thus the net external torque acting on a rigid body rotating about a fixed axis is equal to the moment of inertia about that axis multiplied by the object's angular acceleration with respect to that axis.