Review

- $K_{rotation} = \frac{1}{2} I \omega^2$
- Torque = Force that causes rotation
  - Very loosely speaking: "angular force"
- Equilibrium

  $\Sigma F = 0$

  $\Sigma \tau = 0$

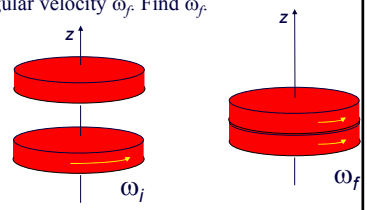
- We had angular everything, displacement, velocity, acceleration, energy and torque
- How about angular momentum?
  - Not for completeness, but for some possibly neat things
  - $F\Delta t = \Delta p$
  - If impulse = 0 (or F = 0), momentum is conserved
  - $rF\Delta t = r\Delta(mv) = \Delta(rmv)$
  - If torque $rF = 0$, rmv is conserved
  - Call it angular momentum (units: $kg \cdot m^2/s$)
  - Given a choice, how do we define angular momentum?

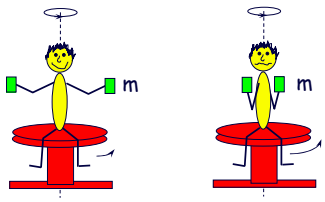
    Momentum $p = mv$

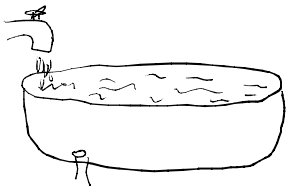
  - $rmv = (mr^2)(v/r)$

    $= I \omega$

- A disk of mass M and radius R rotates around the z axis with angular velocity ω_i. A second identical disk, initially not rotating, is dropped on top of the first. There is friction between the disks, and eventually they rotate together with angular velocity ω_f. Find ω_f.

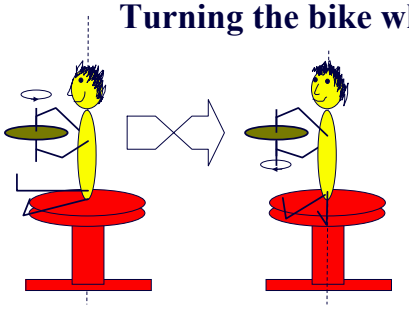




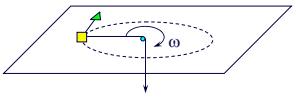


Hurricanes, solar system, and galaxies

Turning the bike wheel

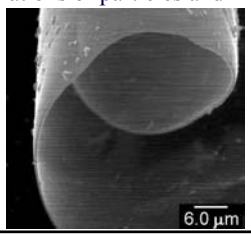


A puck slides in a circular path on a horizontal frictionless table. It is held at a constant radius by a string threaded through a frictionless hole at the center of the table. If you pull on the string such that the radius decreases by a factor of 2, by what factor does the angular velocity of the puck increase?



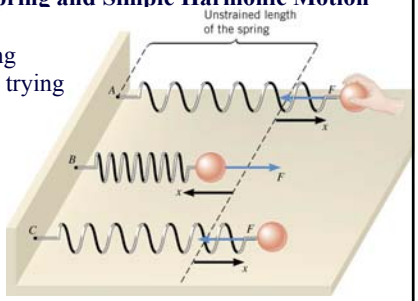
Chapter 10 Simple Harmonic Motion and Elasticity

- Where are they?
- Harmonic Motion
  - Sound, molecular vibrations, all music instruments, light...
  - Everything in quantum physics (there is no such a thing as matter; all matters are combinations of particles and waves)
- Elasticity
  - Everything. There is nothing that is rigid, not even crystals



10.1 The Ideal Spring and Simple Harmonic Motion

- The force of a spring is a restoring force, trying to get back to the relaxed position



- For a spring
  - $F_x = -k\,x$
  - x: displacement from relaxed position
  - k is the constant of proportionality. (often called "spring constant")
- **Hooke's Law:**
- The force exerted by a spring is proportional to the distance the spring is stretched or compressed from its relaxed position.