

## Lecture 8, Sep 27, 2021

### Energy

- Energy comes in many forms: electromagnetic waves, rotational/translational kinetic, thermal, biochemical, etc
- We will study mechanical energy: translational and rotational kinetic energy

### Classifying Collisions

- Elastic collisions:  $\Delta v_{12} \text{ initial} = \Delta v_{12} \text{ final} \equiv |v_2 - v_1|$ 
  - The difference in velocity remains the same before and after the collision, even if the two masses are different
- Totally inelastic collisions:  $\Delta v_{12} \text{ final} = 0$ , i.e. the two objects stick together

### Kinetic Energy

- $K = \frac{1}{2}mv^2$  and does not depend on the direction of motion
- Kinetic energy is conserved in elastic collisions but **not** in inelastic collisions, whereas momentum is conserved in both
- Inelastic collisions usually result in some sort of irreversible change, e.g. irreversible deformations
  - The energy lost goes into the internal energy  $E_{int}$ :  $E = K + E_{int}$
- A closed system has its energy conserved, an open system does not
  - Closed/open for energy, isolated/not isolated for momentum
  - Remember momentum is a vector, so even if the speed does not change, if the direction of motion changes, momentum changes; therefore orbiting planets are not isolated (they change direction and thus momentum)