

Light

Learning Objectives

- ★ Properties of Light
 - Wave and Particle Properties
 - Different forms
- ★ Properties of Matter
 - Atoms
- ★ Interaction of Light and Matter

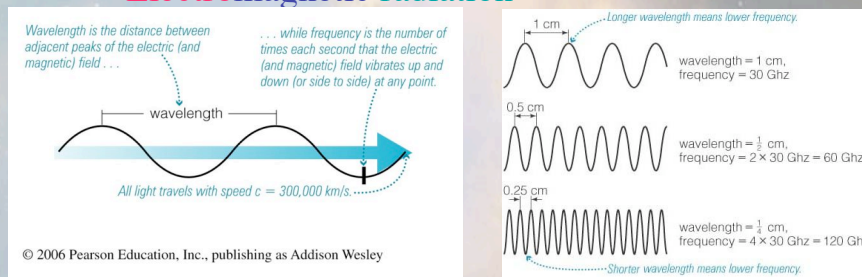
Basic Properties of Light & Matter

- ★ Light - the cosmic messenger
 - How to “read” the message
 - > composition, temperature, motion of object
- ★ What is light?
 - Spectrum, with prism (visible light)



Wave Properties of Light

- ★ Wave: transmits E without carrying along matter
 - Wavelength, λ
 - Frequency, f
 - Speed of wave = c (speed of light)
 - $\lambda f = c = 3.0 \times 10^5 \text{ km/s}$
 - can travel in a vacuum
 - **Electromagnetic radiation**



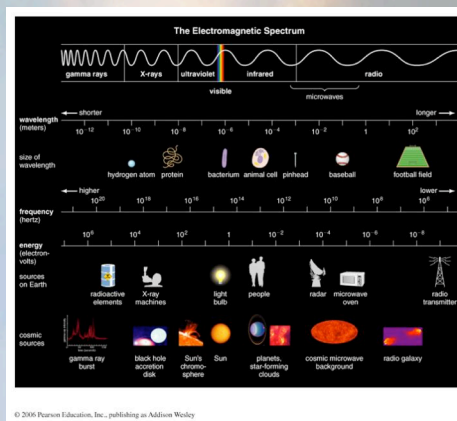
Particle Properties of Light

- ★ Discrete entity - photon
 - photons: packets of EM energy
 - Speed = c
 - (wave-particle duality: paradox)
- ★ Wave-Particle duality: paradox
 - E of photon = $h f = h c / \lambda$

The Electromagnetic Spectrum

★Forms of light

- γ rays, x-rays, ultraviolet (UV), visible (optical), infrared (IR), radio



What is Matter?

★The atom

- p(+), e(-), n
- description of H, He, C
- Isotopes - #p \rightarrow element
#n can vary
- Molecule - combination of two or more atoms bound together

Hydrogen (¹ H)	Helium (⁴ He)	Carbon (¹² C)
atomic number = 1 atomic mass number = 1 (1 electron)	atomic number = 2 atomic mass number = 4 (2 electrons)	atomic number = 6 atomic mass number = 12 (6 electrons)

Isotopes of Carbon		
carbon-12 ¹² C (6 protons + 6 neutrons)	carbon-13 ¹³ C (6 protons + 7 neutrons)	carbon-14 ¹⁴ C (6 protons + 8 neutrons)

Light and Radiation

★ How do light and matter interact?

- emission
- absorption
- transmission
- reflection/scattering

