Today	**Ch 29**	Wave & Particle	**HW27Redo; HW 29**
Wednesday	**Ch 29/30**	Wave & Particle, Atoms	**HW28Redo; HW 30**

Transition – 3 Modern Problems

- **Particle – Wave Duality –** *Today and Friday*
  - **The problem, solution, implications**

Chapter 29 Particles and Waves

29.2 Blackbody Radiation and Planck's constant

Demo: Black body radiator temperature dependence

- **Peak radiation**
- **Spectrum**
- **Physics description**
  - **Kinetic theory**
  - **E & M says**
- **Examples:**
  - **The sun**
  - **You**
- **Quantization**
  - **The Problem**
  - **The Solution**
    - **Photons**

Example1 How much energy does a single photon from our red laser (λ = 634 nm) have?

- **Photon Momentum**

- **Side note: Good Theory / Bad Theory**

29.3 Photoelectric Effect – verifying the Photon model

- **The Effect**
- **The Problem**
- **The Solution**

Example2: The typical molecular bond has an energy in the range of a few electron Volts, eV's. If light, fluctuations in the Electric and Magnetic field, has this much energy and shines on a molecule, it can tear the molecule apart. This is analogous to the photoelectric effect. Say we consider a molecule bound together by 5 eV bonds. What is the threshold wavelength of light that can break this? Where is it on the spectrum?

29.4 Compton Effect – verifying the Photon model

Example3: Say you shone light of wavelength 0.312 nm on a sample. What would be the wavelength of the light that rebounds at 1135 °? What would be its energy?

29.5 De Broglie

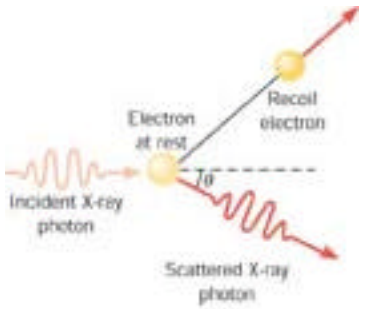
- **De Broglie Wavlength:** $l = \frac{h}{p}$

HW30:Ch29 Pr. 2,8,16,24

2. The dissociation energy of a molecule is the energy required to break apart the molecule into its separate atoms. The dissociation energy for the cyanogens molecule is 1.22×10^{-18} J. Suppose that this energy is provided by a single photon. Determine the (a) wavelength and (b) frequency of the photon. (c) In what region of the electromagnetic spectrum does the photon lie?

8. Light is incident on the surface of metallic sodium, whose work function is 2.3 eV. The maximum speed of the photoelectros emitted by the surface is 1.2×10^{6} m/s. What is the wavelength of the light?

16. In a Compton scattering experiment, the incident X-rays have a wavelength of 0.2685 nm, and the scattered X-rays have a wavelength of 0.2703 nm. Through what angle are the X-rays scattered?



24. How fast does a proton have to be moving in order to have the same de Broglie wavelength as an electron that is moving at 4.50×10^{6} m/s?