Stuff for Tuesday, April 17, 2012

- Midterm: Any 2 hours in Sm1009 from 6:30 to 10pm, Wed., May 2.
- Sm1094 session tomorrow (remember 2:30pm!). Quiz #4 Friday.

1. Quanton in a box: $V(x) = 0$ for $0 \le x \le L$ and infinite outside.

$$\psi_{E_n}(x) = \begin{cases} A \sin \frac{n\pi x}{L} & \text{if } 0 \le x \le L \\ 0 & \text{outside} \end{cases} \qquad E_n = \frac{h^2 n^2}{8mL^2} = \frac{p_n^2}{2m}\,, \quad p_n = \frac{h}{\lambda_n} = \frac{h}{(2L/n)}$$

2. Harmonic oscillator: $V(x) = \frac{1}{2}k_s x^2 = \frac{1}{2}m\omega^2 x^2 \qquad (\omega = \sqrt{k_s/m})$

$$E_n = \frac{h\omega}{2\pi}(n + \frac{1}{2}) = \hbar\omega(n + \frac{1}{2})\,,\ n = 0, 1, 2, \ldots \text{(cf. quanton in box: } n = 1, 2, 3, \ldots)$$

3. Bohr model of hydrogen atom: circular orbit of radius r

$$E_n = -\frac{ke^2}{2a_0 n^2} = -\frac{13.6\,\text{ev}}{n^2} \qquad a_0 = 0.053\,\text{nm (Bohr radius)},\ r_n = n^2 a_0$$

- Spectral lines: $E_{\text{photon}} = E_i - E_f = \frac{hc}{\lambda_{\text{emitted}}} \Longrightarrow \lambda_\gamma = hc/E_{\text{photon}}$
  - $\lambda_{\text{box}} \propto 1/(n_i^2 - n_f^2)\,, \quad \lambda_{\text{HO}} \propto 1/(n_i - n_f)\,, \quad \lambda_{\text{Bohr}} \propto n_i^2 n_f^2/(n_i^2 - n_f^2)$