Stuff for Tuesday, April 24, 2012

- 1094 tomorrow. Quiz #5 Thursday on Q9-11.
- SchroSolver.exe available from H133 page. Save, double-click to run.

Summary:

- Specify atomic levels by $\{n, l, m, m_s\}$. One electron for each combination.
- Selection rule for photon transitions: $\Delta l = \pm 1 \Longrightarrow$ metastable states
- Local wavelength: $[2\pi/\lambda(x)]^2 = -\frac{d^2 f/dx^2}{f(x)}$
- Schrödinger equation from $K = p^2/2m = [(2\pi\hbar)/\lambda]^2/2m = E - V(x)$:

$$-\frac{\hbar^2}{2m}\frac{d^2\psi_E(x)}{dx^2} + V(x)\psi_E(x) = E\psi_E(x)$$

numerical: $\psi_E(x_{i+1}) = 2\psi_E(x_i) - \psi_E(x_{i-1}) - \frac{8\pi^2 mc^2 \Delta x^2}{(hc)^2}[E - V(x_i)]\psi_E(x_i)$

Energy eigenfunctions of the hydrogen atom

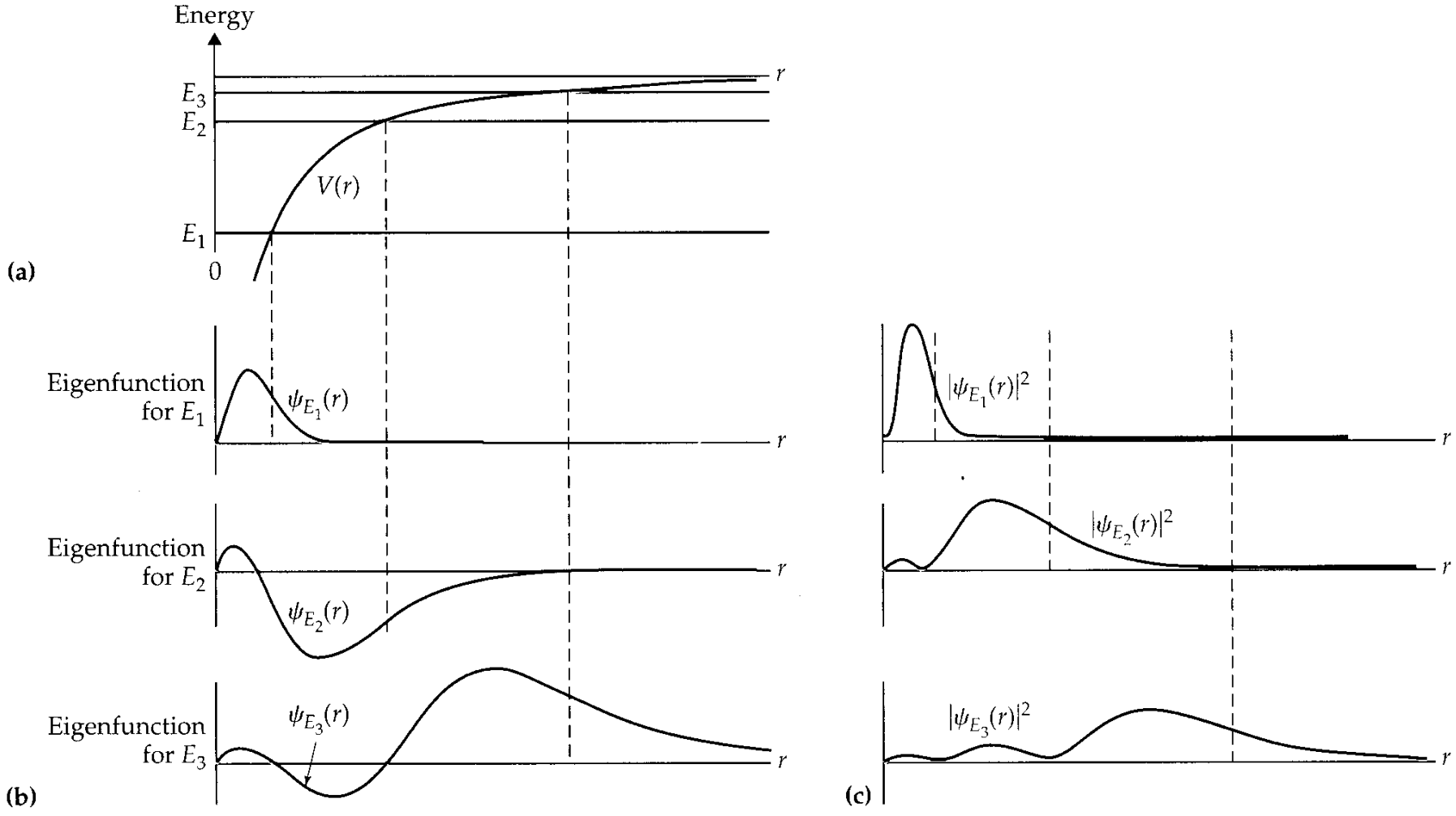
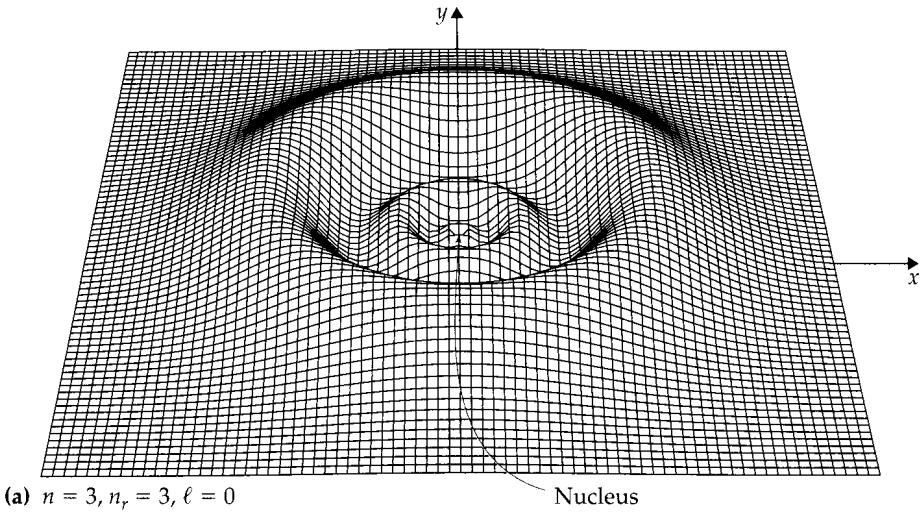


Figure Q9.1

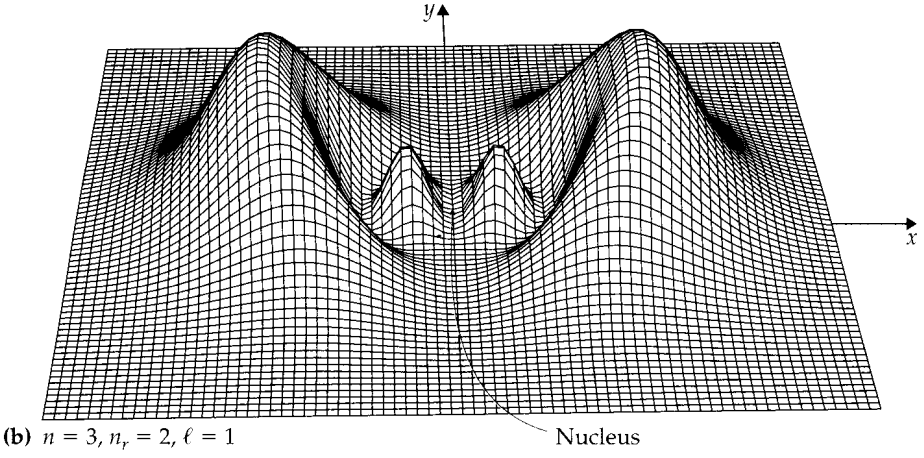
(a) A graph of the potential energy of an electron in a hydrogen atom. (b) The energy eigenfunctions for the three lowest energy states of radial motion. (c) The absolute squares of those wavefunctions.

- $l = 0$ (s-wave) radial wave functions and absolute squares

Plots of $|\mathrm{Re}\Psi(x, y, z = 0)|^2$ for hydrogen $n = 3$

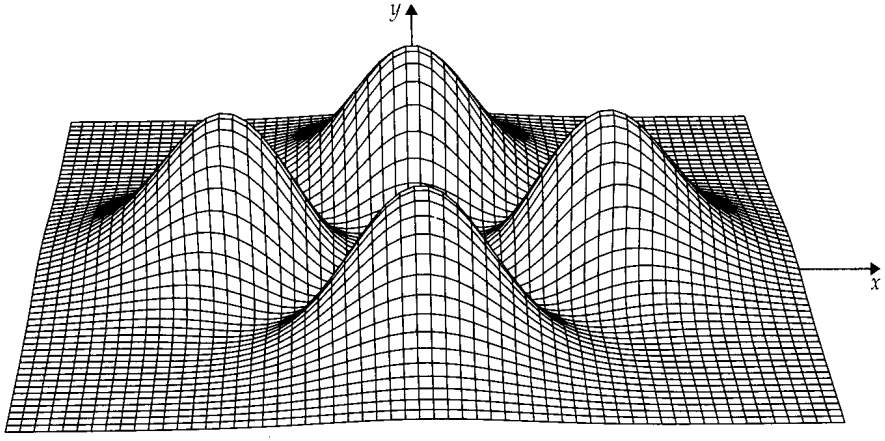


(a) $n = 3, n_r = 3, \ell = 0$



(b) $n = 3, n_r = 2, \ell = 1$

- $n = n_r + l$ with $n_r = 1, 2, \ldots$ and $l = 0, 1, \ldots$
- Here $(n_r, l) = (3, 0)$, $(2, 1)$, and $(1, 2)$



(c) $n = 3, n_r = 1, \ell = 2$

Figure Q9.2

Plots of the square of the (real part of the) electron energy eigenfunctions in hydrogen (evaluated in the *xy* plane) for $n = 3$ and various values of ℓ. Note how as ℓ increases, the number of radial bumps n_r decreases.