→ solution to the radial wave eq. w/ no potential: $U'' + (K^2 - \frac{\ell(\ell+1)}{r^2})U = 0$, where $K^2 = 2mE$ and $U = r R(r)$, is

$$R_\ell(r) = a_\ell j_\ell(Kr) + b_\ell n_\ell(Kr)$$

in the limit of $K \to 0$ (and, thus, $\ell = 0$), the total cross section is (Abers 8.121)

$$\sigma_{tot}(0) = \frac{4\pi}{K^2}\sin^2\delta_0$$

For impenetrable sphere of radius a, $\tan\delta_0 = -\frac{b_\ell}{a_\ell} = \frac{j_\ell(Ka)}{n_\ell(Ka)} \Rightarrow \delta_0 = -Ka$

→ H.O. ($\hbar = 1$) $a^+|n\rangle = \sqrt{n+1}\,|n+1\rangle$, $a|n\rangle = \sqrt{n}\,|n-1\rangle$

$$H = \omega(a^+a + \tfrac{1}{2}) \qquad X = \frac{1}{\sqrt{2m\omega}}(a + a^+) \qquad p = \sqrt{\frac{m\omega}{2}}\,(a - a^+)$$

→ $\sigma_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$, $\sigma_y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$, $\sigma_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$

→ Helium system consists of 2 identical fermions (electrons), so its wave function has to be antisymmetric, 2 ways this is possible: (1) spatial part antisymmetric & spin part symmetric (2) spatial part symmetric & spin part antisymmetric

→ variational method: (1) Normalize trial wave function; (2) Find $\langle H\rangle$ by $\langle \frac{p^2}{2m}\rangle$ & $\langle V\rangle$; (3) take derivative of $\langle H\rangle$ wrt parameter to find extremum; (4) plug parameter in to $\langle H\rangle$ to get E

→ green's function for wedge: $4\sum_{n=1}^{\infty}\frac{1}{n}\left(\frac{\rho_<}{\rho_>}\right)^{\frac{n\pi}{\alpha}}\sin(\frac{n\pi}{\alpha}\phi)\sin(\frac{n\pi}{\alpha}\phi')$, α is angle between planes of wedge $\measuredangle\alpha$

→ potential for Dirichlet B.C. ($\Phi = 0$ on surface):

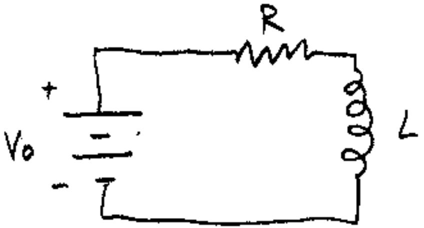
$$\Phi(\vec{r}) = \int_V \rho(\vec{r}')\, G(\vec{r};\vec{r}')\, d^3r'$$

→ probability density: $P(t) = \psi^*(t)\,\psi(t) \Rightarrow \frac{\partial P}{\partial t} = \dot{\psi}^*\psi + \psi^*\dot{\psi}$

→ selection rule:

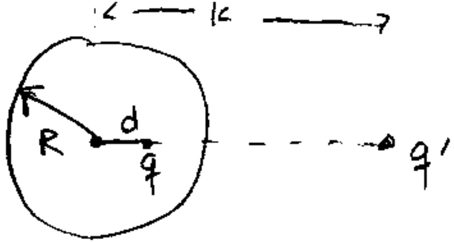
$$\langle n'\ell'm'|z|n\ell m\rangle \neq 0 \quad \text{if } |\Delta m| = 0 \ \&\ |\Delta\ell| = 1$$

Things Ye Should Memorize: 1999



$$\Rightarrow V_0 - IR - L\frac{dI}{dt} = 0$$

$$P = I^2 R \quad , W = \frac{1}{2} L I^2 \quad \& \; W = \int_0^\infty P \, dt$$



$$q' = -\frac{qR}{d} \quad , K = \frac{R^2}{d}$$

$$F = \frac{q q'}{(K-d)^2} = \frac{-q^2 R d}{(R^2 - d^2)^2}$$