2014A

<u>5666</u> particle in 2D box with SO

$|x| < a, \quad |y| < b, \quad , \quad g = 2, \; e = 1, \; c = 1$

$V(x) = \frac{1}{2} V_0 \, \mathrm{sgn}(x)$

$$H = \frac{1}{2}\vec{p}^{\,2} + V(x) + \frac{V_0}{4} \sigma_z \delta(x) \, p_y \qquad [\text{here } M=1]$$

$$\mathcal{E}_{n,m} = \frac{1}{2}\left[\left(\frac{\pi}{2a}n\right)^2 + \left(\frac{\pi}{2b}m\right)^2\right] \qquad \text{for } V_0 = 0$$

$$|n\, m\rangle \to \frac{1}{\sqrt{ab}} \, \mathrm{SIN}\left(\frac{\pi}{2a} n x\right) \mathrm{SIN}\left(\frac{\pi}{2b} m y\right)$$

$$\mathrm{SIN} = \cos/\sin \quad \text{for } n = 1, 3, \ldots / 2, 4, \ldots$$

$$\langle n, 1 | V(x) | 1, 1\rangle = \frac{2}{\pi} V_0 C_n \qquad n = 2, 4, \ldots$$

$$\Delta E^{(V)}_{1,1} = -\frac{32}{\underbrace{\pi^4}_{M}} V_0^2 a^2 \sum_{n=2,4,\ldots} \frac{C_n^2}{n^2 - 1} \qquad \left[\begin{matrix}\text{here we} \\ \text{place } M \text{ back}\end{matrix}\right]$$

with SO the $n = 2, 4 \ldots$ are not affected

$$\langle n m | H^{SO} | 1 1\rangle = \sigma_z \frac{V_0}{4} \cdot \frac{-i}{ab} \int_{-b}^{+b} dy \, \sin(\ldots m y) \frac{\partial}{\partial y} \cos(\ldots y)$$

$$= -i \, \sigma_z \frac{V_0}{2ab} C_m$$

$n = 1, 3, \ldots \quad m = 2, 4, \ldots$

$$\Delta E^{SO}_{1,1} = -\frac{V_0^2}{2\pi^2} \frac{1}{M^3 a^2 b^2} {\sum_{n,m}}' \frac{C_m^2}{\frac{n^2-1}{a^2} + \frac{m^2-1}{b^2}} \qquad \left[\begin{matrix}\text{here we} \\ \text{place } M \text{ back}\end{matrix}\right]$$