January 2000 QM 3

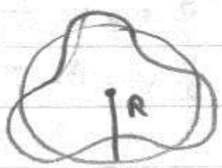
$$H = \frac{1}{2m}\left(\vec{p} - \frac{q}{c}\vec{A}\right)^2 - \vec{\mu}\cdot\vec{B} \qquad B_z = \left(\vec{\nabla}\times\vec{A}\right)_z = \frac{1}{r}\frac{\partial}{\partial r}(r A_\phi) = B_0$$

$$\Rightarrow A_\phi = \frac{1}{2} B_0 r$$

particle confined to circle $\Rightarrow$ only $p_\phi \neq 0$

$$H = \frac{1}{2m}\left(p_\phi + \frac{e}{c}\frac{1}{2}B_0 r\right)^2 - g\mu_B B_0 \cdot \frac{1}{2}\sigma_z$$

$$H = \frac{m}{2}\left(\frac{p_\phi}{m} + \frac{1}{2}\Omega R\right)^2 - \mu_B B_0 \sigma_z \qquad \Omega = \frac{eB_0}{mc}$$



$$2\pi R = n\lambda \qquad p_\phi = \hbar k$$

$$\frac{2\pi}{\lambda} R = n \qquad p_\phi = \frac{\hbar}{R} n$$

$$kR = n$$

$$E = \frac{m}{2}\left(\frac{\hbar}{Rm} n + \frac{1}{2}\Omega R\right)^2 \pm \mu_B B_0$$

$$E = \frac{m}{2}\left(\frac{\hbar}{mR}\right)^2\left(n + \frac{1}{2}\frac{mR}{\hbar}\Omega R\right)^2 \pm \mu_B B_0$$

$$E = \frac{\hbar^2}{2mR^2}\left(n + \frac{1}{2} m R^2 \frac{\Omega}{\hbar}\right)^2 \pm \mu_B B_0$$

$$E = \frac{\hbar^2}{2mR^2}\left(n + \frac{1}{2}\frac{e}{\hbar c} B_0 R^2\right)^2 \pm \mu_B B_0 \qquad n = 0, \pm 1, \pm 2, \pm 3, \ldots$$