GERAK ELEKTRON DALAM MEDAN MAGNET

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Tanpa $\vec{B}$ Hamiltonian $H_0 = \dfrac{\vec{P}^{\,2}}{2\mu}$ (1)

Dengan medan $\vec{B}$ $\vec{P} \rightarrow \vec{P} + \dfrac{e}{c}$

Hamiltonian menjadi $H = \dfrac{1}{2\mu}\left[\vec{P} + \dfrac{e}{c}\vec{A}\right]^2 - e\phi$ (2)

$$\vec{A} = -\frac{1}{2}\vec{r}x\vec{B}$$

$$\vec{A}.\vec{P} = -\frac{1}{2}\left(\vec{r}x\vec{B}\right).\vec{P}$$

$$= \frac{1}{2}\vec{B}.\left(\vec{r}x\vec{P}\right) = \frac{1}{2}\vec{B}.\vec{L}$$

Sehingga persamaan 2 menjadi:

$$H=\frac{1}{2\mu}\left[\vec{P}^{2}+\frac{e}{c}\vec{L}.\vec{B}+\frac{e^{2}}{4c^{2}}\left(r^{2}B^{2}-\left(r.B\right)^{2}\right)\right]-e\phi \qquad (3)$$

$$=\frac{P^{2}}{2\mu}+\frac{e}{2\mu c}BL_{z}+\frac{e^{2}B^{2}}{8\mu c}\left(x^{2}+y^{2}\right)-e\phi \qquad (4)$$

$$\frac{\frac{e^{2}}{8\mu c^{2}}\left(a_{0}^{2}B^{2}\right)}{\frac{e\hbar}{2\mu c}\left(B\right)}=\frac{B}{9x10^{9}\,Gauss}$$

Efek Zeeman normal

$$H = H_0 + H_{\text{int}}$$

$$H_0 = \frac{P^2}{2\mu} - e\phi \; ; H_{\text{int}} = \left(\frac{e}{2\mu c}\right) B L_z$$

Dalam konteks atom hidrogenik $H_{\text{int}} \psi_{nlm}(r) = \hbar \omega_L m \psi_{nlm}(r)$

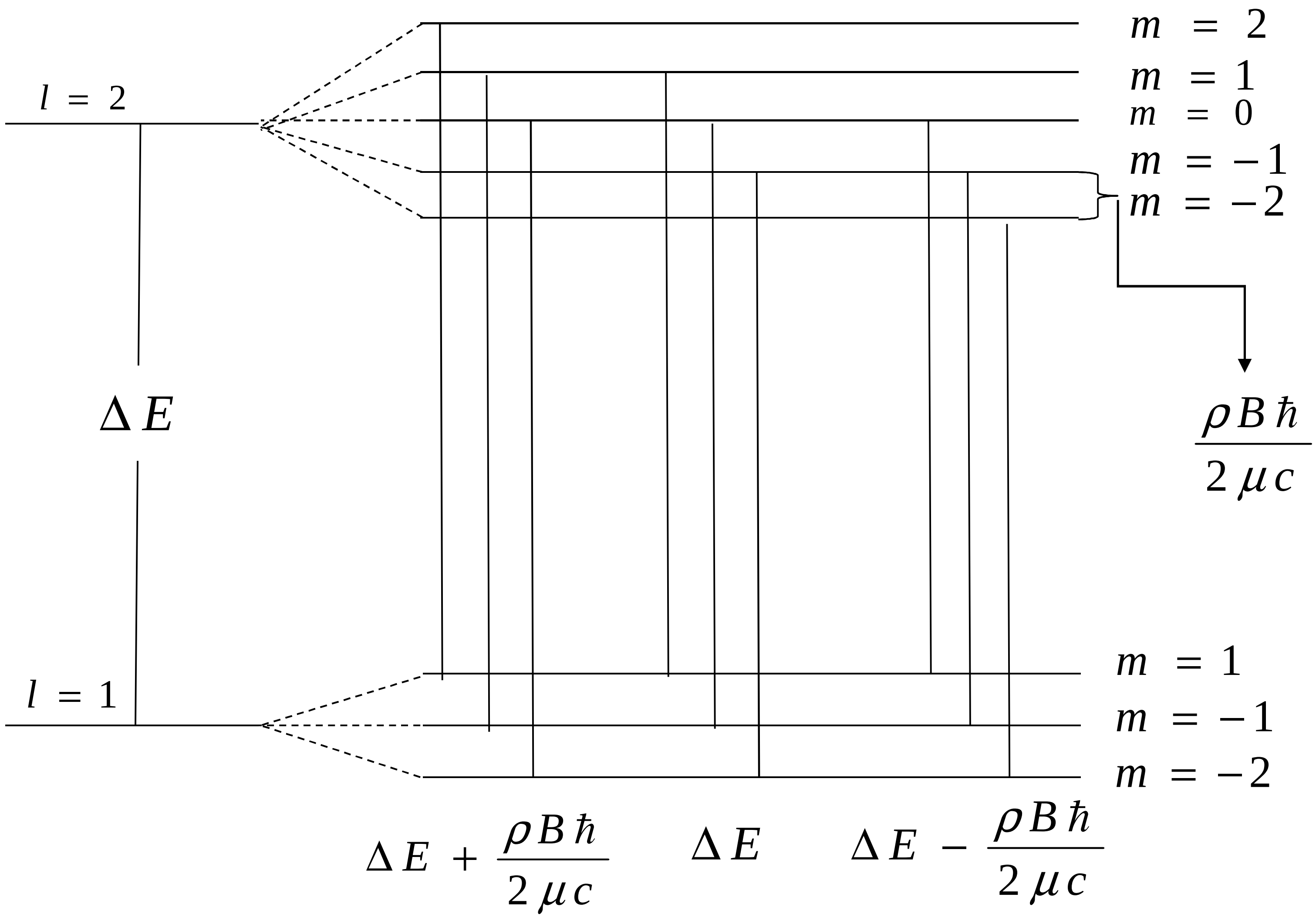
$$\omega_L = \frac{eB}{2\mu c} \equiv frekuensi\, lamor$$

$$m\hbar \; nilai\; Eigen\, L_z \;,\; -l \le m < +m$$

$$E = -\frac{1}{2}\mu z^2 \frac{e^n}{n^2 \hbar^2} + \hbar\omega_L m \qquad ; \hbar\omega_L = \frac{B.13{,}6\, eV}{2{,}4.10^9 \; gauss} << E_0$$

Transisi radiasi antar tingkat energy mengikuti aturan seleksi $|\Delta m| \le 1 \; atau\, \Delta m = -1,\; 0,\; 1$

Tentukan transisi radiasi efek Zeeman Normal dari *l*=2 ke *l*=1. Atom hydrogen dan tunjukkan hanya ada 3 garis Zeeman



$l = 2$
$m = 2$
$m = 1$
$m = 0$
$m = -1$
$m = -2$
ΔE
$\frac{\rho B \hbar}{2 \mu c}$
$l = 1$
$m = 1$
$m = -1$
$m = -2$
$\Delta E + \frac{\rho B \hbar}{2 \mu c}$
ΔE
$\Delta E - \frac{\rho B \hbar}{2 \mu c}$