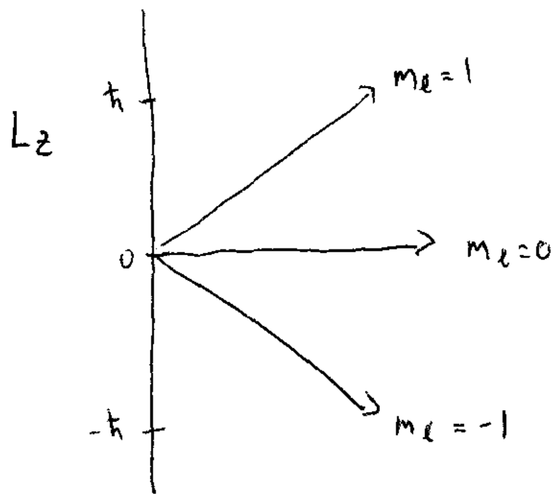
$\vec{L}$ - orbital angular momentum

$$L^2 = \ell(\ell+1)\hbar^2$$

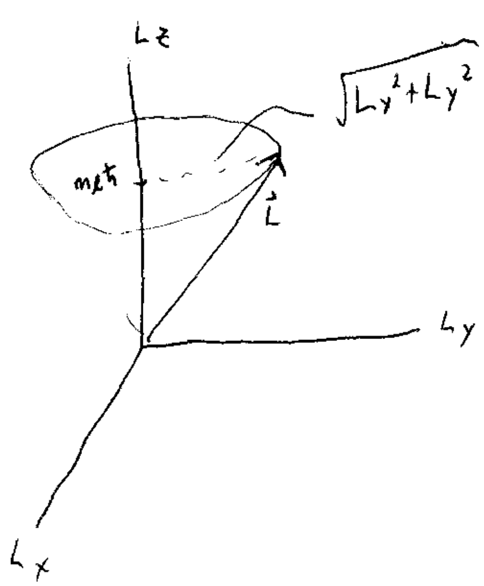
$$L = \sqrt{\ell(\ell+1)}\,\hbar$$ - L is quantized

$$L_z = m_\ell \hbar$$ - z component of angular momentum



$2p\,(m_\ell = 0)$ $\quad \psi \sim \cos\theta$ - antisymmetric about x-y plane

$2p\,(m_\ell = 1)$ $\quad \psi \sim \sin\theta\, e^{i\phi}$ symmetric about x-y plane



only L and $L_z = m_\ell \hbar$ can be simultaneously known

$n = 1, 2, 3, \ldots$ principle quantum number

$l = 0, 1, 2 \ldots n-1$ orbibital Angular Momentum quantum number

$m_l = -l, -l+1 \ldots l-1, l$ magnetic Quantum number

Spectroscopic notation

$n\, l\, (m_l = m_e)$

integer

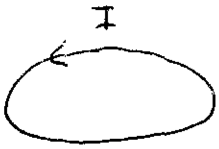
$l = 0$	s	sharp
1	p	principle
2	d	diffuse
3	f	fundamental
4	g	
5	h	
6	i	

example 1s is ground state (m_l must be 0)

2s is first excited state with $l = 0$ (m_l must be 0)

$2p_{(m_l=0)}$ first excited state, $l = 0$, $m_l = 0$

Intrinsic Angular Momentum,



for a ring of current

$\mu = IA$

μ - magnetic moment

for a single quanta of charge

$I = \frac{q}{T}$ T - period

Kepler's law $\frac{A}{T} = \frac{L}{2m}$ A - area swept out

$\vec{\mu} = \frac{q}{2m} \vec{L}$

magnetic moment only in terms of $\vec{L}$

for an electron $\mu = -\frac{e}{2m} \vec{L}$

$-\frac{e}{2m}$ electron gyro magnetic ratio

possible values of L_z are multiples of $\hbar$

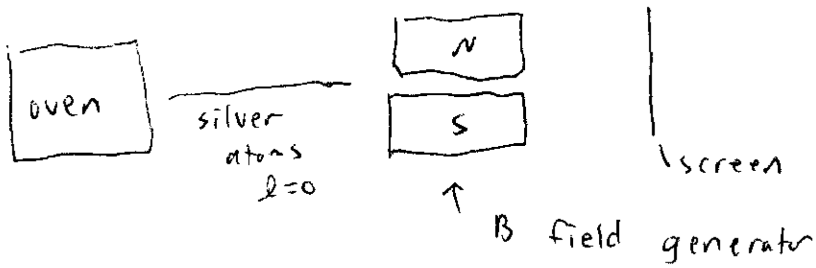
$\mu_B \equiv \frac{e\hbar}{2m}$ bohr magnetron

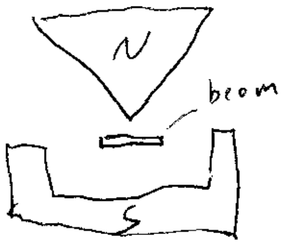
Electron spin

Stern - Gerloch experiment

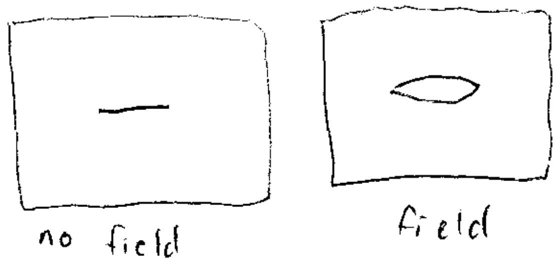
for $l=0$, $m_l=0$

A magnetic field gradient will produce a force $F_z = -\mu_z \frac{\Delta B}{\Delta z}$





results :



There is an addition component of angular momentum not counted for, and has 2 possible values.

this is electron spin!

electron intrinsic angular momentum

$$\vec{\mu}_s = -\frac{e}{2m} g \vec{S}$$

$$S = \sqrt{s(s+1)}\,\hbar \qquad S_z = m_s \hbar$$

$$s = \tfrac{1}{2} \qquad m_s = -\tfrac{1}{2}, \tfrac{1}{2}$$