The total angular momentum

$$\vec{J} = \vec{L} + \vec{S}$$

Note that $\vec{\mu}$ and $\vec{J}$ don't have the same direction! (because of g)

The component of $\vec{\mu}$ along $\vec{J}$ is reffered to as the effective magnetic moment (μ_{eff})

Now if $\vec{B}_{ext}$ exist, $\vec{\mu}$ will have a potential energy $U = -\vec{\mu} \cdot \vec{B}_{ext}$

($\vec{\mu}$: total magnetic moment!)

$\vec{B}$ along the z-axis:

$$U = \omega_L \hbar m_\ell + \omega_L \hbar g m_s$$

$$-\ell \leq m_\ell \leq \ell \quad \text{and} \quad m_s = \pm \frac{1}{2}$$

The energy level will be split first because of m_ℓ and then because of m_s

for electron $g = 2$!