

-X-X-X-X-X-X-X-

Addition of angular momenta

Triplet configurations for $s=1$

$$|1 \ 1\rangle = |\uparrow \uparrow\rangle$$

$$|1 \ 0\rangle = \frac{1}{\sqrt{2}} (|\uparrow \downarrow + \downarrow \uparrow\rangle)$$

$$|1 \ -1\rangle = |\downarrow \downarrow\rangle$$

triplet

$S=1$ configuration

singlet configuration

$$|0 \ 0\rangle = \frac{1}{\sqrt{2}} (|\uparrow \downarrow - \downarrow \uparrow\rangle) \quad s=0 \quad \text{singlet configuration}$$

Two particle system

e^-
↓
spin $1/2$

three possible
combinations

p^+
↓
spin $1/2$

\uparrow
 \downarrow
 $\frac{1}{\sqrt{2}} (\uparrow\downarrow)$

$\uparrow\uparrow$
 $\downarrow\downarrow$
 $\downarrow\uparrow$

Eigen functions of total spin

$\left[\begin{array}{l} \text{z component} \\ \text{of spin} \\ \text{angular} \\ \text{momentum} \end{array} \right] S^2$ Total spin value

S
 S_z

[magnetic
spin]

m_s : orientation
for spin
angular momentum

L^2 $\left[\begin{array}{l} \text{z component of} \\ \text{orbital angular} \\ \text{momentum} \end{array} \right]$

[magnetic orbital]

m_l : orientation for the
orbital angular momentum

eigen functions of S^2

$$S^2 = 2\hbar^2$$

$$S^2 = S_x^2 + S_y^2 + S_z^2$$