

Addition of angular momentum 3

Let $\Psi = Y_{lm}\chi_{\pm}$ be an eigenstate of J^2 . Then for $j = l + \frac{1}{2}$

$$J^2\Psi = j(j+1)\hbar^2\Psi$$

The following Ψ are eigenstates of J^2 .

$$\Psi = Y_{l,l}\chi_{+} \tag{1}$$

$$\Psi = Y_{l,-l}\chi_{-} \tag{2}$$

For $-l < m < l$ the following Ψ are also eigenstates of J^2 .

$$\Psi = \left(\frac{l+m+1}{2l+1}\right)^{1/2} Y_{lm}\chi_{+} + \left(\frac{l-m}{2l+1}\right)^{1/2} Y_{l,m+1}\chi_{-} \tag{3}$$

See farside.ph.utexas.edu/teaching/362k/04_Addition.pdf.