

5.73

Quiz 35

For p^3 configuration:

The $M_L = 0, M_S = 1/2$ block contains $||1\alpha 0\alpha - 1\beta||, ||1\alpha 0\beta - 1\alpha||,$
and $||1\beta 0\alpha - 1\alpha||$. For $M_L = 0$, \mathbf{L}^2 may be replaced by $\mathbf{L}_+ \mathbf{L}_-$.

$$\mathbf{L}^2 ||1\alpha 0\alpha - 1\beta|| = \hbar^2 [2 ||1\alpha 0\alpha - 1\beta|| - 2 ||1\alpha 0\beta - 1\alpha||]$$

$$\mathbf{L}^2 ||1\alpha 0\beta - 1\alpha|| = \hbar^2 [4 ||1\alpha 0\beta - 1\alpha|| - 2 ||1\beta 0\alpha - 1\alpha|| - 2 ||1\alpha 0\alpha - 1\beta||]$$

$$\mathbf{L}^2 ||1\beta 0\alpha - 1\alpha|| = \hbar^2 [2 ||1\beta 0\alpha - 1\alpha|| - 2 ||1\alpha 0\beta - 1\alpha||]$$

A. Set up the \mathbf{L}^2 matrix for the $M_L = 0, M_S = 1/2$ block.

B. Find the normalized eigenvector of \mathbf{L}^2 that corresponds to $|^2 D M_L = 0, M_S = 1/2\rangle$

$$(\mathbf{L}^2) \begin{pmatrix} a \\ b \\ c \end{pmatrix} = \hbar^2 6 \begin{pmatrix} a \\ b \\ c \end{pmatrix} \quad 1 = [|a|^2 + |b|^2 + |c|^2]^{1/2}$$

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5.73 Quantum Mechanics I
Fall 2018

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