Course:Physics of Atoms and Molecules/Exercises/Notation

1 Notation

- **L** denotes the *total* orbital angular momentum $\mathbf{L} = \sum_i \mathbf{l_i}$, with $\mathbf{l_i}$ single-particle angular momentum. The eigenvalues of L^2 are such that $L^2|\varphi >= \hbar^2 L(L+1)|\varphi >$ and are simply denoted by the letter L. The eigenvalues of $\mathbf{L_z}$ are such that $\mathbf{L_z}|\varphi >= \hbar m_L|\varphi >$ and are simply denoted by the letter m_L
- **S** denotes the *total* spin $\mathbf{S} = \sum_i \mathbf{s_i}$, with $\mathbf{s_i}$ single-particle spin.The eigenvalues of S^2 are such that $S^2|\varphi >= \hbar^2 S(S+1)|\varphi >$ and are simply denoted by the letter S. The eigenvalues of $\mathbf{S_z}$ are such that $\mathbf{S_z}|\varphi >= \hbar m_S|\varphi >$ and are simply denoted by the letter m_S
- **J** denotes the *total* angular momentum $\mathbf{j_i} = \mathbf{l_i} + \mathbf{s_i}$, $\mathbf{J} = \sum_i \mathbf{j_i}$ .The eigenvalues of J^2 are such that $J^2|\varphi >= \hbar^2 J(J+1)|\varphi >$ and are simply denoted by the letter J. The eigenvalues of $\mathbf{J_z}$ are such that $\mathbf{J_z}|\varphi >= \hbar m_J|\varphi >$ and are simply denoted by the letter m_J
- Keep in mind the **addition rules for angular momenta**: let us call $\mathbf{J_1}, \mathbf{J_2}$ two arbitrary angular momenta.

$$\begin{aligned} \mathbf{J_{tot}} &= \mathbf{J_1} + \mathbf{J_2} \\ m_{J_{tot}} &= m_{J_1} + m_{J_2} \\ |J_1 - J_2| &\leq J_{tot} \leq J_1 + J_2 \\ -J_{tot} &\leq m_{J_{tot}} \leq +J_{tot} \end{aligned}$$

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2.1 Text

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