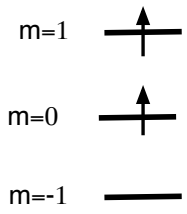
Intermediate Quantum 492: HW #7 Extra

Spectroscopic Term and Hund's Rules

Determine the spectroscopic term for the ground state of Carbon. First, make a table of all possible values of ℓ, s and j. Include a column for the symmetry of the spatial part and the spin part as $\pm$. Eliminate the rows of the table that are excluded by the Pauli principle. Add a column for the spectrocopic term ${}^{2S+1}L_J$ for all Pauli allowed rows. Finally, apply Hund's rules to determine the ground state.

You can get the same result using a short-cut (from Gasiorowicz). Make a drawing with horizonal lines ("shelves") corresponding to the values of m_ℓ for the L of the sub-shell. Distribute the electrons as up or down arrows on the shelves, only doubling up on an m_ℓ when necessary and using Hund's rule 1 to maximize the sum of s_z which gives S. Sum the m_ℓ for the shelves to get L as $L = \sum n_i \cdot m_i$ where n_i is the number of electrons on the self. Use Hund's rule 3 to give J. For Carbon the diagram would be,



S = 1/2+1/2=1

L= ∑n_i*m_i = 1(1)+1(0)+0(-1) = 1

Use this technique to find the spectroscopic term for oxygen and manganese.