PROBLEM SET 3

Oct. 16 Colloquium: “Nonlinear Dynamics, Parity, and Geometry: The Emergence of Structure in Inhomogeneous Turbulence”

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3 pm, 101 Rowland Hall (formerly PS I)

1. Eisberg and Resnick: 7.4

2. Identify the atoms that have the following ground state electronic configurations in their outer shell or shells: (a) $3s^2 3p^6 3d^8 4s^2$, (b) $4s^2 4p^4$, (c) $4s^2 4p^6 4d^2 5s^2$, (d) $4s^2 4p^6 4d^1 5s^2$, (e) $4s^2 4p^6 4d^{10} 4f^3$.

3. Show that the multiplicity of a level, defined as the number of different $J$–values that can be formed from given $L$ and $S$ values, is $2L + 1$ or $2S + 1$, whichever is smaller.

4. What are the values of $L$, $S$, and $J$ and the multiplicities of the levels having the following term designations: $^1S_0$, $^3D_2$, $^4P_{5/2}$, $^2F_{7/2}$, $^6I_{13/2}$?

5. What types of terms can result from the following values of $L$ and $S$? (Answer in spectroscopic notation.) (a) $L = 1$, $S = 1/2$ (b) $L = 3$, $S = 1$, (c) $L = 2$, $S = 7/2$, (d) $L = 5$, $S = 3/2$. (Partial answer: (a) $^2P_{1/2}$, $^2P_{3/2}$).

6. What spectral terms result from an electron configuration $3d 4f$, assuming LS coupling?

7. In the transition $^4F_{3/2} \rightarrow ^{10}D_{1/2}$, how many lines will appear in the Zeeman pattern? Explain your reasoning by listing the allowed transitions.