

Optical pumping Pre-Lab

1. Read Melissinos pp 218-232.
2. With reference to Figures 2A-2 and 2D-3 of the lab guide, estimate the energy differences (order of magnitude) in eV between each of the following pairs of states of Rb:

(a) $5^2S_{1/2} - 5^2P_{3/2}$

(b) $5^2P_{1/2} - 5^2P_{3/2}$

(c) $5^2S_{1/2}(F=2) - 5^2S_{1/2}(F=3)$

(d) $5^2S_{1/2}(F=2, M_F=-1) - 5^2S_{1/2}(F=2, M_F=0)$ in a magnetic field of 1 gauss ($10^{-4}T$).

3. In thermal equilibrium at 320K how many atoms in a mole of Rb would one expect to find in the $5^2P_{1/2}$ state? What is the difference in the population of the lowest and highest magnetic substates of the ground state in a field of 1 gauss at this temperature?

4. What fractional contributions does the nucleus of a rubidium atom make to its (a) angular momentum; (b) magnetic moment?