

Due: before the end of instruction

16. Optical pumping in ^{199}Hg . The ground state of the mercury atom has $J=0$, while the nuclear spin for this isotope is $I=1/2$. Suppose we apply a short pulse of circularly polarized light tuned in resonance with a transition to an excited $J'=1$ state.
- What are the hyperfine-structure levels in the ground and the excited state?
 - What is the nuclear polarization (the average projection of the nuclear spin on the direction of the circular polarization of the light) right after the excitation pulse? Give a qualitative explanation to this result.
 - What is the nuclear polarization as a function of time?
 - Explain how the results above pertain to optical pumping of nuclear spins. In parts b-c, only consider the atoms in the excited electronic state.