Header styling inspired by CS 70: https://www.eecs70.org/

1. What is the general principle of optical pumping? Go over your derivation of the Breit-Rabi formula and the values of the Lande g-factors of the hyperfine energy levels of ^{85}RB and ^{87}RB showing the fine, hyperfine, and Zeeman splittings. How do the Lande g-factors affect the ordering of the Zeeman levels? Show the transitions between these levels that are important to this experiment. Include these drawings in your write-up. For our rubidium system, what is the pumping process? Where is the pumped level? Where is the RF transition?

   Solution: The general idea of optical pumping is to observe the transitions between the ground and excited states of atoms, from null $|F, m_F\rangle$ to null $|F, m_F + 1\rangle$. why are we only considering $m_F + 1$? Why can't the increase be fractional?

   Because simply exciting the electrons with the magnetic field has no effect on the system, and instead we need to spin polarize everything so that we see a change. □

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2. Why do we modulate (vary sinusoidally) the external magnetic field? How do we take data if the magnetic field were not modulated?

3. In this experiment, how will we determine the resonance frequency? How can we best estimate the error? Will the modulation amplitude affect our result? What data will we take, and what plots will you make?