Calcium Spectroscopy Using a Tunable External Cavity Diode Laser

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Abstract: Laser spectroscopy can be used to precisely measure electronic transitions in atoms and molecules. External cavity diode lasers (ECDLs) provide a convenient, low-cost, yet robust source of tunable laser light that can provide the required precision. By varying the diode current, temperature, and/or cavity length, the frequency of 866nm light from an ECDL can be scanned through an atomic resonance of ionized Ca. Absorption of the laser light by the ions indicates particular D to P electronic transitions within the atoms. Analysis of this absorption allows us to know the precise wavelength of our laser to within picometers and reveals information about the finite spectral linewidth of the atomic transition. The next step will be to lock our laser to the frequency associated with this transition in order to perform Doppler cooling of calcium ions contained in an RF trap.