Physics 482-01 and 690-01: Quantum Optics & Atomics
Due date: Thursday, March 7, 2024

Problem Set #4

Dressed Atoms and Optical Trapping

1. Write a 2-page essay (typed, double spaced) that summarizes the related results of the two papers:

A. Ashkin, "Acceleration and Trapping of Particles by Radiation Pressure", *Phys. Rev. Lett.* **24**, 156 (1970).

S. Chu, J. E. Borkholm, A. Ashkin, and A. Cable, "Experimental Observation of Optically Trapped Atoms", *Phys. Rev. Lett.* **57**, 314 (1986).

2. On a separate sheet, provide a quantitative justification for one of the quantitative claims in one of the two papers above … hint: pick a very simple claim, since most of the quantitative claims will be very difficult to prove.

Extra Graduate Student Problem
3. Mollow triplet at low photon number
a) Calculate the splitting of the Mollow triplet for ^{87}Rb for a laser a beam with 0 photons/s, 1 photon/s, 2 photons/s, 3 photons/s. The laser has a flat-top intensity profile with a diameter of 100 μm at a wavelength of 780 nm.
b) Repeat the above calculations, but in the case that the atoms are in an optical cavity which causes the laser beam to be reflected upon itself 10^6 times.