MOT - Atom Trapping

Signature Sheet

Student's Name _____ Partner's Name _____

Pre-Lab Discussion Questions

It is your responsibility to discuss this lab with an instructor before your first day of your scheduled lab period. This signed sheet must be included as the first page of your report. Without it you will lose grade points. You should be prepared to discuss at least the following before you come to lab:

1. Describe quantitatively how closed-loop control allows one to steer the output of a system to a desired level and to make the system immune to many disturbances.
2. How is the emission frequency of the laser measured and controlled in this experiment?
3. How does a half-wave plate affect the polarization of an incident, linear polarized laser beam, and how is this effect used in your experiment. How does a quarter-wave plate affect the polarization of an incident circular polarized laser beam?
4. Laser light with wavelength near 780 nm sent through a room-temperature vapor of rubidium may be attenuated by the vapor. If one records the transmitted laser power as one varies the laser frequency over a broad range (many GHz), what features does one expect to see (positions, widths, signal strengths) and what is their origin?
5. What are the safety requirements for working with this laser?

Staff Signature _____ Date _____

Completed before the first day of lab? (Circle one) Yes / No

Mid-Lab Discussion Questions

On day 3 of this lab, you should have measured the frequency response of the system, created a Bode plot of your measurements, and successfully produced a stable MOT. Show them to an instructor and ask for a signature.

1. Explain how the Doppler shift yields a damping force when atoms are exposed to counter-propagating laser beams of equal frequency. Derive the damping coefficient β.
2. Referencing the section in the laboratory manual on the "release-and-catch" method of measuring the temperature, derive an expression for the radius r of the atomic gas as a function of the time of flight TOF.

Staff Signature _____ Date _____

Completed by day 3 of lab? (Circle one) Yes / No

Checkpoint Signatures

1. Power

   Staff Signature _____

2. Two Quarter-Wave Plates

   Staff Signature _____

3. Four Peaks

   Staff Signature _____

4. Adjustments

   Staff Signature _____

5. Results and Steps

   Staff Signature _____

6. Methods of Measuring Temperature

   Staff Signature _____