Optical Pumping of Rubidium OP1-A

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(Dated: November 18, 2014)

Abstract

I. INTRODUCTION

In our experiment, optical pumping is conducted where light is used to "pump" electrons from a lower energy level in Rubidium atoms to higher energy levels achieving population inversion. This process of optical

II. EXPERIMENT

To implement the optical pumping process, we used the apparatus shown in Fig. 3, manufactured by TeachSpin Inc.

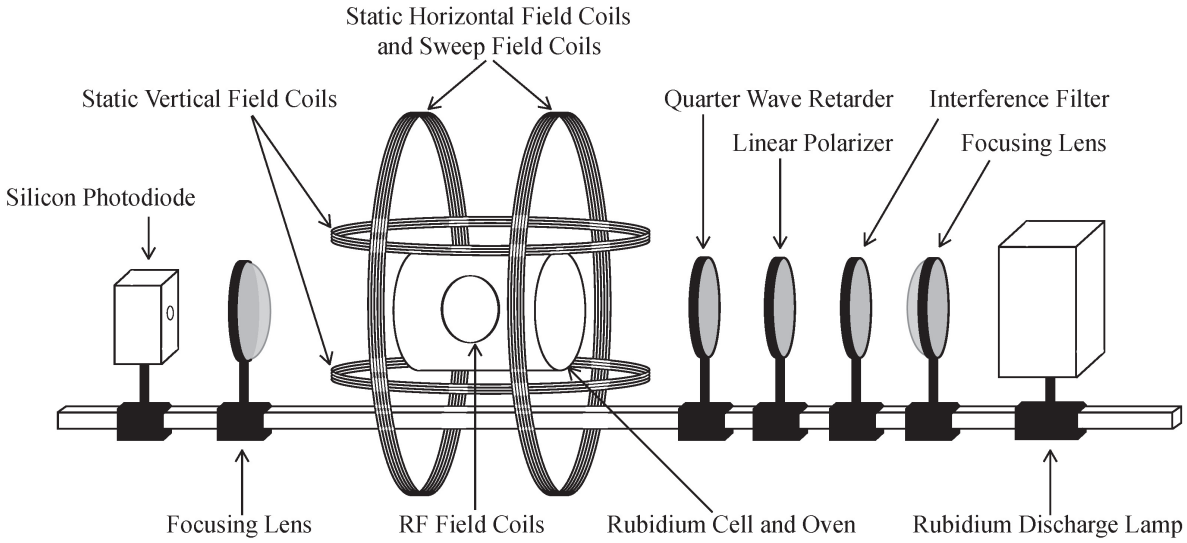

FIG. 1. Optical pumping of Rubidium apparatus

On the right side of the optical rail, the interference filter limits the bandwidth of light with a pass band of 790 nm to 830 nm, and the linear polarizer and quarter wave retarder convert the light from random polarization to circular polarization. The circular polarized light mandates only $\delta M = +1$ electric dipole transitions in the atom.The Helmholtz coils provide the magnetic fields, are driven by dial controlled variable voltage dividers, and are monitored by two Agilent 34410 digital multimeters and a Tektronix 2024B oscilloscope.

The left side of the optical rail measures the intensity of light passing through the sample which in effect allows us to see when the sample is driven out of the optically pumped state. This signal is also monitored by the oscilloscope. The RF field coils are driven by an HP33120A function generator and drive the sample out of the optically pumped state when the sweep field is at resonance.

III. RESULTS

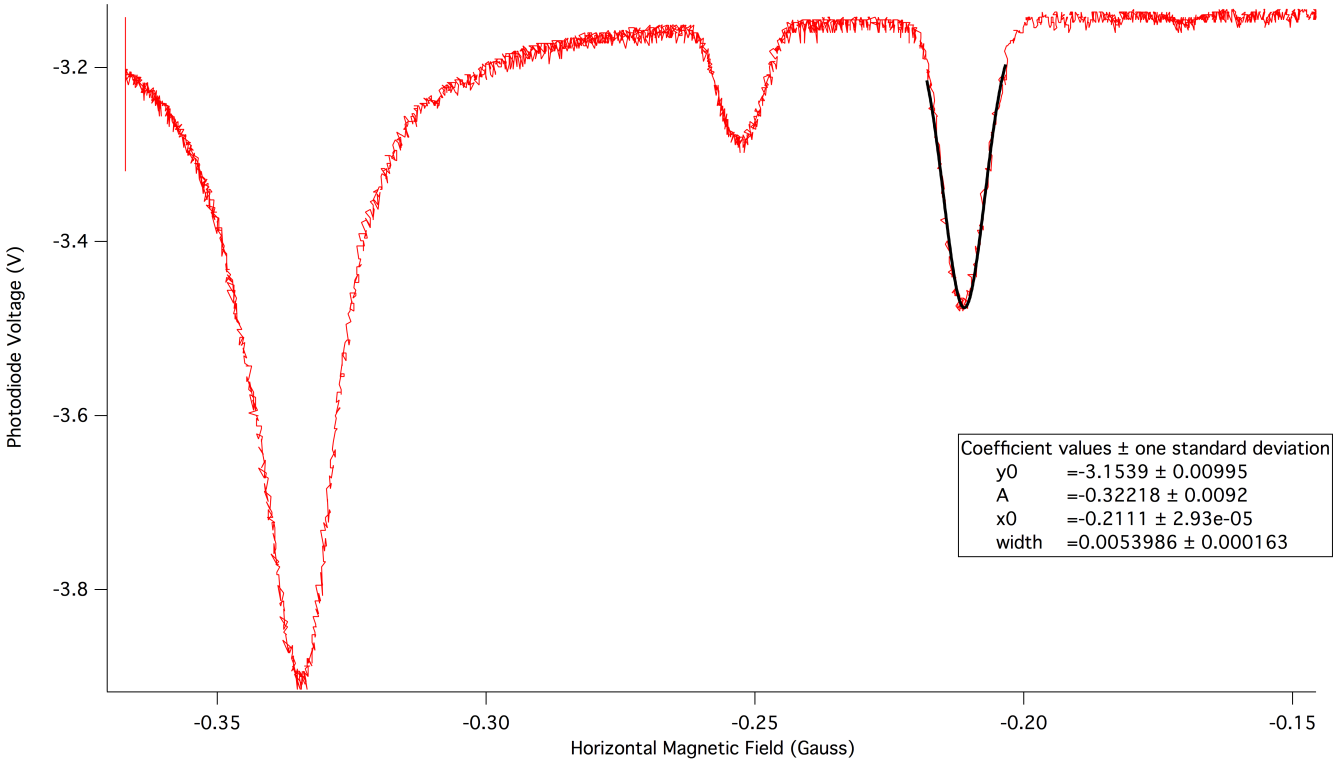

FIG. 2. Photo-voltage versus magnetic field strength at 100 kHz. The left trough is the zero field resonance, the middle trough is RF absorption for $^{8}7$Rb and the right trough is for Rb.

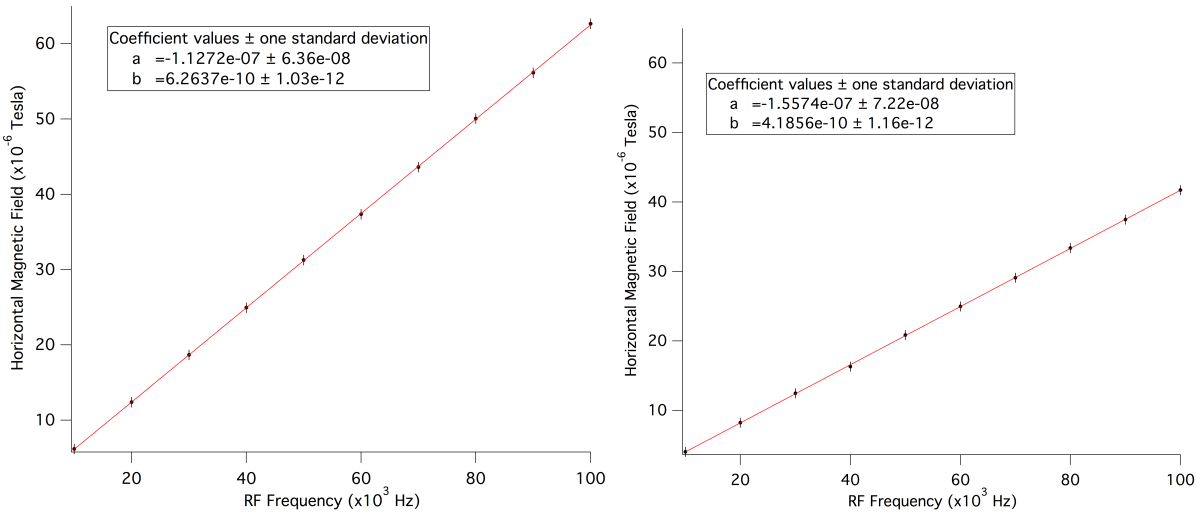

FIG. 3. Horizontal magnetic field strength at 100 kHz. The left trough is the zero field resonance, the middle trough is RF absorption for $^{8}7$Rb and the right trough is for Rb.

IV. DISCUSSION

V. CONCLUSION

ACKNOWLEDGMENTS

We gratefully acknowledge Nathanael Fortune and Dana Parsons, who helped with the experimentation and editing of this experiment. This work was supported by the Smith College Physics Department.

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[1] TeachSpin Instructions Manual, *Optical Pumping of Rubidium OP1-A*, 6/2002.