



香港科技大學
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UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Your Defense Title

Your Name

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Supervisor: Prof. Your Supervisor

Department of Physics, HKUST

2020/11/30



Contents

1. Introduction

2. Theory of light-atom interaction

2.1 EIT and Slowlight in Three-level system

3. System Configuration

3.1 MOT and Optical layout

4. Experiment

4.1 Adjust switch-off device and bias coil

5. Conclusion & Outlook



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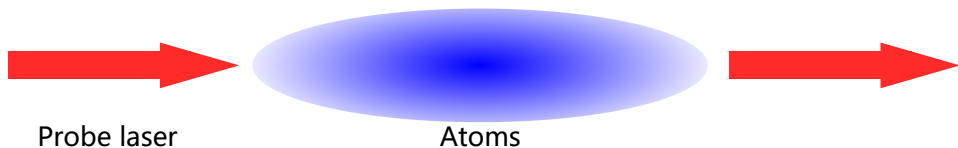
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Introduction



- ▶ EIT and slowlight in Rubidium 85 atom system
- ▶ Dephasing affects the efficiency
- ▶ Control the magnetic field to decrease dephasing



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Three-level system

$$\hat{H}_{\text{eff}} = \hbar \begin{pmatrix} 0 & 0 & -\frac{1}{2}\Omega_p^* \\ 0 & -\delta - \frac{i\Gamma_2}{2} & -\frac{1}{2}\Omega_c^* \\ -\frac{1}{2}\Omega_p & -\frac{1}{2}\Omega_c & -(\Delta + \delta) - \frac{i\Gamma_3}{2} \end{pmatrix}$$

coupling detuning: $\Delta = \omega_c - (\omega_3 - \omega_2)$

probe detuning: $\delta = \omega_p - \omega_c - (\omega_2 - \omega_1)$

$$a_3 = \frac{2\Omega_p(\delta + \frac{i\Gamma_2}{2})}{|\Omega_c|^2 - 4(\Delta + \delta + \frac{i\Gamma_3}{2})(\delta + \frac{i\Gamma_2}{2})}$$

$$\chi = \chi(\delta) = \frac{N|\mu_{13}|^2}{\epsilon_0\hbar} \frac{4(\delta + i\frac{\Gamma_2}{2})}{|\Omega_c|^2 - 4(\delta + \Delta + i\frac{\Gamma_3}{2})(\delta + i\frac{\Gamma_2}{2})}$$



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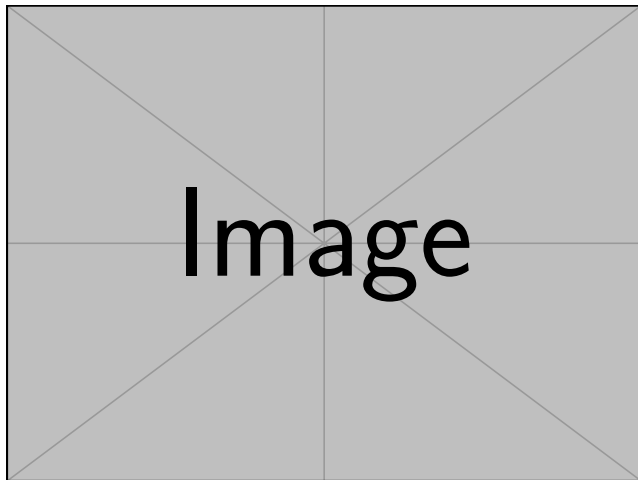
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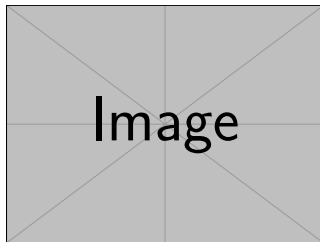
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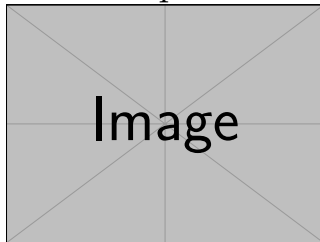
MOT and Optical layout



Circuit (see appendix)



Hall probe



Bias coil design



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Adjust switch-off device

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Conclusion & Outlook

► Conclusion

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► Outlook

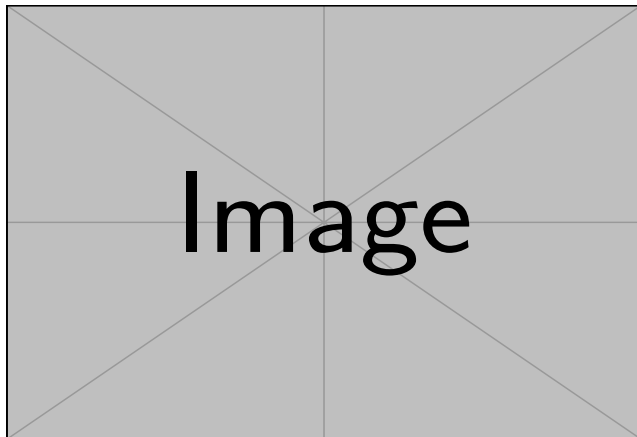
- Automatically adjust the bias currents by computers and tools like machine learning¹

¹Wigley, P. B. *et al.* Fast machine-learning online optimization of ultra-cold-atom experiments. *Scientific reports* **6**, 1–6 (2016)



Appendix: ...

The circuit for the project is:





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Thank you!

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