Building Single Molecules from Single Atoms

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Abstract

Contents

Acknowledgments

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Introduction

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Apparatus

1.1 Cooling and optical pumping beams

(MOT, OP, fiber back reflection)

(Mention Na Raman beam to be covered in later chapter?)

1.2 Tweezer and imaging

1.3 Molecular Raman frequency generation

(beam path, calibration)

2

Computer control of the experiment

2.1 Overall structure

2.2 Frontend

2.3 Backends

(communication protocol)

3

Raman sideband cooling

4

Interaction of single atoms

4.1 Scattering length

(Importance/relation with binding energy etc.)

4.2 Energy levels of two interacting atoms in an anisotropic trap

4.3 Interaction shift spectroscopy

(motional sideband, scattering length result)

4.4 Summary and Outlook

(Motional state selection)

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Photoassociation of single atoms

5.1 Energy levels

5.2 Effect of the trap

(light shift, broadening)

5.3 Photoassociation spectroscopy

(v=0, 12, 14, etc)

6

Two-photon spectroscopy of NaCs ground state

(N=2, different HF states)

7

Coherent optical creation of NaCs molecule

8

Conclusion