Trapping - Cooling - Quantum Control

Summer term 2019 - Lecturer: Tobias Schätz, Leon Karpa

Assignment sheet 10

please hand in your solutions by July 3rd, 18:00.

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1) Excited Electronic State Lifetimes

a) A qubit can be encoded in the electronic state of a single trapped ion. To achieve long coherence times it is important to identify long lived electronic states. How can you estimate the lifetime of an excited electronic state? Explain your strategy from a theoretical and experimental perspective using sketches and keywords.

Hint: You can use Wineland, D. J. et al. *Experimental issues in coherent quantum-state manipulation of trapped atomic ions.* J. Res. Natl. Inst. Stand. Technol. 103, 259–328 (1998) as a source.

(2 Points)

2) Magic Magnetic Field Strengths

a) How can you calculate 'magic' magnetic field strengths, where the qubit transitions are in first order independent of the magnetic field? What are the advantages of conducting quantum experiments at such magnetic field strengths? Use keywords, formulas and sketches to explain.

(2 Points)