Imaging of trapped single Rb atoms

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Abstract

We report on the trapping, and imaging of single atoms in a magneto-optical trap (MOT). The high localization of cold single atoms [1] has an increasing variety of interests aimed applications ranging from triggered single photon source [2] and photon-atom entanglement [3] to atom strings as a quantum register [4] aiming towards quantum information.

The fluorescence of atoms in low atomic density collected with an APD is used to observe the signature of atoms captured in the trap. An atom entering or leaving the trap will produce a discrete change in the fluorescence level. The discrete steps are thus associated with atoms either being loaded in the trap from background Rb vapour, or from atoms lost due to background gas collisions. A histogram of occurrence of a given count rate is constructed from a long term observation.

The fluorescence of a single atom in the trap is imaged by a CCD for observation times of about one minute at the same time with the APD signal, and the resulting steps are compared with those from the APD.

In the future we indent to use Fourier filtered absorption imaging to image free single atoms released from the trap.

Keywords: single atom, MOT, low atom number detection, immaging

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