

Q 39 Gruppenbericht Quanteninformaton

Zeit: Mittwoch 10:40–11:10

Raum: HI

Gruppenbericht

Q 39.1 Mi 10:40 HI

Single Photons for Quantum Networks — •TATJANA WILK, SIMON WEBSTER, HOLGER SPECHT, AXEL KUHN, and GERHARD REMPE — Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, D-85748 Garching

Recently, the storage of a single atom inside a high-finesse optical cavity for an average time of 17 s has been demonstrated [1]. Such atom-cavity systems with the ability to generate single photons [2] can form the nodes in a quantum network, where the photons act as flying qubits and couple or entangle distant nodes [3]. In order to do so the photons need to be mutually coherent and thus indistinguishable. We therefore have developed a new scheme for the generation of polarized single photons in a coupled atom-cavity system. Together with the cavity, a pump laser drives Raman transitions between the $m_F = \pm 1$ Zeeman substates of the $F = 1$ hyperfine ground state of a single ^{87}Rb atom. This allows us to generate a stream of photons with alternating polarization. The mutual coherence of subsequent photons is characterized in a two-photon interference experiment [4], where their suitability for applications in quantum information processing such as linear optical quantum computing [5] is verified.

[1] Nufmann et al. *Nature Physics* **1**, 122 (2005)

[2] Kuhn et al. *Phys. Rev. Lett.* **89**, 67901 (2002)

[3] Cabrillo et al. *Phys. Rev. A* **59**, 1025 (1999)

[4] Legero et al. *Phys. Rev. Lett.* **93**, 70503 (2004)

[5] Knill et al. *Nature* **409**, 46 (2001)