DAMOP16-2016-000565

Abstract for an Invited Paper
for the DAMOP16 Meeting of
the American Physical Society

Cavity Quantum Electrodynamics: A Universal Quantum Optics Toolbox

GERHARD REMPE, Max Planck Institute of Quantum Optics, 85748 Garching, Germany

Electromagnetic resonators provide unparalleled capabilities in controlling the interaction between light and matter. The recently developed techniques for trapping and cooling atoms between closely spaced mirrors now open up new experimental avenues for genuine quantum-mechanical experiments. Particularly exciting possibilities concern long-distance quantum networking and scalable quantum computation. Recent achievements like the nondestructive detection of an optical photon [1], the realization of a quantum gate between a single atom and a single photon [2], and the heralded and efficient conversion of a flying qubit into a stationary qubit [3] are past highlights. The longstanding dream of a quantum gate between individually addressable photonic qubits might become reality in the future. The talk will summarize recent experiments and give an outlook onto future directions.

[1] A. Reiserer et al., Science 342, 1349 (2013).
[2] A. Reiserer, et al., Nature 508, 237 (2014).
[3] N. Kalb, et al., PRL 114, 220501 (2015).