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Ion-trap single-photon source for quantum networks TRACY NORTHUP, HELENA BARROS, ANDREAS STUTE, CARLOS RUSSO, PIET SCHMIDT, University of Innsbruck — Trapped ions coupled to an optical cavity are a promising route toward quantum networks, in which the quantum states of the ions could be mapped onto photon states for transportation over fiber pathways. We describe an ion-based cavity-QED system consisting of a single trapped $^{40}Ca^{+}$ ion coupled to the mode of a high-finesse optical resonator. Intra-cavity photons are generated in a vacuum-stimulated Raman process between two atomic states driven by a laser and the cavity vacuum field. We have observed Raman spectra as a function of drive laser frequency and find excellent quantitative agreement with theoretical simulations. Here we demonstrate and characterize single-photon generation: we evaluate the photon statistics of the source by measurements of the second-order correlation function $g^{(2)}(\tau)$, and the temporal profile of the photon exiting the cavity allows us to investigate the dynamics of the Raman transfer process. Furthermore, through comparisons with simulation, we assess the coherence of the process and discuss its application for entanglement protocols.

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