Abstract Submitted
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Realizing Collective Strong Coupling with Ion Coulomb Crystals in an Optical Cavity[1] J.P. MARLER, A. DANTAN, M. ALBERT, P.F. HERSKIND, M. DREWSEN, QUANTOP, Danish Research Foundation Center for Quantum Optics, University of Aarhus, Denmark — Clouds of cold ions are an interesting alternative system to a single atom/ion for studying CQED effects. When trapped and cooled below a critical temperature, ions form a spatially ordered state, referred to as an ion Coulomb crystal. In our setup, we trap and cool $^{40}Ca^{+}$ ions in sufficient number to access the so-called strong collective coupling regime, where the collective coupling, $g\sqrt{N}$, exceeds both the dipole decay rate, γ, and the cavity decay rate, κ. We will present the first signals of collective strong coupling, in this system - most dramatically manifested via the vacuum Rabi splitting. Finally, we measure the temporal coherence of collective Zeeman sub-states in the $3d^3D_{3/2}$-level by induced Larmor precession. The measured coherence times are of the order of the best reported values for single ions in equivalent magnetic field sensitive states. Our results make the system a promising candidate for the realization of various quantum information devices, including quantum repeaters and quantum memories.

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