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Driven and dissipative quantum dynamics in ultra-long lived dipoles in an optical cavity[1] DIEGO BARBERENA, JILA, and Dept. of Physics, University of Colorado, 440 UCB, Boulder, CO 80309, USA, ROBERT LEWIS-SWAN, ANA MARIA REY, JILA, NIST, and Dept. of Physics, University of Colorado, 440 UCB, Boulder, CO 80309, USA — Alkaline earth atoms (AEA) are becoming unique quantum platforms for the simulation of complex quantum many-body systems and for the realization of the most precise atomic clocks. Recent developments in cavity QED implementations using AEAs are now allowing us to take advantage of their long-lived clock states and rich internal structure to explore a new regime of cavity QED where a single optical cavity mode can mediate strong exchange interactions and collective superradiant decay in many-body systems [1]. Here we report new investigations in the regime where an external field is used to additionally coherently drive the clock transition. It is known that, even in the absence of exchange interactions, this system exhibits a dynamical phase transition and a steady state with useful entanglement properties. To assess possible experimental signatures of the dynamical phase transition and to analyze the modifications introduced by cavity mediated interactions, we study the long time behavior of different spin observables and the spectrum of the emitted light. We also investigate the modifications of the entanglement properties of the steady state generated by exchange interactions and how can they be used for enhanced metrology.
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[1]NSF-PFC, AFOSR-MURI and NIST

Diego Barberena
JILA, and Dept. of Physics, University of Colorado, 440 UCB

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