Abstract Submitted
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Tailoring Atom-Light Coupling with Atomic Lattices[1] TAYLOR L. PATTI, DOMINIK S. WILD, EPHRAIM SHAHMOON, MIKHAIL D. LUKIN, SUSANNE F. YELIN, Harvard University — We examine a mechanism by which the steady-state excitation likelihood of a single target atom in a weak driving field can be enhanced by many orders of magnitude and/or serve as a long-term quantum memory via interaction with a proximal atomic square lattice. Additionally, we consider an alternate configuration of this mechanism which produces many-body photon bound states on the lattice and produces strong near-field effects. The addition of a second target atom to this system yields coherent, array-mediated coupling between the two emitters. These phenomena are highly sensitive to relative atomic linewidth, polarization, and detuning between the impurity atom of interest and those of the array, and can be conceptualized as impurity interaction with array band structure and collective decay modes. In the case of an infinite lattice, we introduce these interactions in terms of the impuritys self-induced energy and Rabi drive, which stem from its interaction with lattice normal modes. Moreover, we develop an analytic toy model which elucidates both the intuition of these states as well as the relative experimental flexibility in lattice size.

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