Abstract Submitted
for the APR15 Meeting of
The American Physical Society

Quantum dissipative dynamics of two-level atoms in hyperbolic metamaterials CRISTIAN CORTES, Department of Electrical and Computer Engineering, University of Alberta, Edmonton, AB T6G 2V4, Canada, GIACOMO TORLAI, Department of Physics, University of Waterloo, Ontario, Canada N2L 3G1, ZUBIN JACOB, Department of Electrical and Computer Engineering, University of Alberta, Edmonton, AB T6G 2V4, Canada — Hyperbolic metamaterials (HMMs) represent a class of artificial nanostructured media that have garnered a lot of attention over the past few years due their broadband singularity in the photonic density of states. This unique property has led to many research directions ranging from subwavelength light manipulation to the control of radiative decay rates of quantum emitters in HMMs. Here, we apply a second quantization approach, first developed by Dekker (1975), to study the quantum dissipative dynamics of a two-level atom coupled to a hyperbolic medium. The Dekker quantization approach provides a framework that allows for non-Hermitian Hamiltonians whose imaginary part represents the dissipation of the quantum system. We calculate the resonance fluorescence spectrum and steady-state dynamics of a two-level atom in an HMM. Our results take into account non-idealities of the medium such as loss and finite unit-cell size and should be experimentally observable using current nanofabrication technology.

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Date submitted: 09 Jan 2015 Electronic form version 1.4