Abstract Submitted
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Observing Spontaneous Emission Phenomena Using Lattice-Trapped Atoms Coupled to Free Space[1] LUDWIG KRINNER, MICHAEL STEWART, ARTURO PAZMINO, JOONHYUK KWON, DOMINIK SCHNEBLE, Stony Brook University — It has been predicted that quantum optical models for spontaneous emission in photonic band gap materials can be realized with ultracold atomic systems[2]. We experimentally implement such a scenario using ultracold Rb-87 atoms initially trapped in a state selective optical lattice. Coupling to a freely propagating internal state releases matter-waves (wave-continuum), while a populated/unpopulated lattice site simulates the excited/ground states of an "artificial atom". We present recent experimental results on the time evolution of the system, for which we find both Markovian as well as strongly non-Markovian dynamics. We characterize the momentum distribution of the emitted matter waves, for which we find close agreement with theoretical predictions. A careful analysis allows for an identification of the equivalent of a Lamb shift, and provides indirect evidence for the analog of the atom-photon bound state in photonic band gap materials.

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[2]I. de Vega et. al, Phys. Rev. Lett. **101**, 260404, 2008; M. Stewart et. al, Phys. Rev. A **95**, 013626, 2017

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