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Resonance Fluorescence and Photon Correlations Produced by 1-10 Qubits in 1D Infinite or Semi-Infinite Waveguides[1] YAO-LUNG L. FANG, HAROLD BARANGER, Duke University — We study multiple two-level systems (2LS) coupled to a 1D waveguide in which one end is open and the other is either open (infinite waveguide) or closed (semi-infinite). Resonance fluorescence and two-photon correlations are presented for weak coherent driving. We show that while for a single 2LS coupled to an infinite waveguide the reflected photons are initially anti-bunched, for a semi-infinite waveguide they become highly bunched. As the number of 2LS increases (up to 10), rapid oscillations build up in the correlations that persist for a long time. At the same time, incoherently reflected photons are mostly distributed within the photonic band gap when driven resonantly, accompanied by sharp side peaks. Our calculations can be explained using the poles of the Green function in the Markovian regime together with the notion of time delay. Finally, in the non-Markovian regime we demonstrate that a 2LS in a semi-infinite waveguide can no longer be decoupled by placing it at the node of the photonic field, in sharp contrast to a recent experimental finding in the Markovian regime using superconducting qubits.

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