A Multimode Analysis of an Atom-Cavity System as a Controlled Phase Gate WILLIAM KONYK, JULIO GEA-BANACLOCHE, Univ of Arkansas-Fayetteville — We study the scattering of a single- and two-photon pulse off of a three-level atom in the V configuration contained within a cavity. Our solution utilizes a full multimode treatment of the quantized electric field and leads to analytic results for common input pulses. We use this solution to analyze the system's ability to act as a conditional phase gate between two photons for various choices of couplings and detunings. We find that the maximum success probability is nearly identical to that obtained for a similar atom in a chiral waveguide configuration. We also show that the initial pulse shape has a significant effect on the gate operation, in some cases entirely preventing the ideal π phase shift between the two photons for any choice of parameters.

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