A Full Quantum Multimode Treatment of an Atom in a Waveguide[1] WILLIAM KONYK, JULIO GEA-BANACLOCHE, Univ of Arkansas-Fayetteville — We apply a full multimode treatment of the quantized electric field to a single two level atom in a bidirectional waveguide, a system that has been proposed for "photon sorting" and other quantum information processing tasks. Starting with a photon pulse consisting of an arbitrary number of photons, all with the same pulse shape, we derive the equations of motion and an expression for the shape of the pulse after its interaction with the atom. For a two photon Gaussian pulse, and for a "flat-top pulse" composed of error functions, we consider the shape of the final spectrum and the non-classical nature of the light. We find that with a small coupling between the atom and the field modes there exists a region where the output light is strongly antibunched with a high probability of single-photon detection. We also explore the reflection and transmission properties of the atom along with detection probabilities of the photons on each channel.

William Konyk
Univ of Arkansas-Fayetteville

Electronic form version 1.4