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Nonlinear Optics with an Atomic Ytterbium Vapor K.R. MOORE, E.A. ALDEN, A.E. LEANHARDT, University of Michigan, Ann Arbor, MI 48109, USA — A theoretical analysis of two-photon cascade emission and four- wave mixing in a three-level atomic system is presented. The specific levels of interest are the $^1S_0$, $^3P_1$, and $^3D_2$ states in atomic ytterbium. Cascade emission along the decay path $^3D_2 \rightarrow {}^3P_1 \rightarrow {}^1S_0$ generates photons at 1479 nm and 556 nm, respectively. For various emission directions, this decay sequence can produce either (i) polarization-entangled photon pairs or (ii) entanglement between the polarization of one of the emitted photons and the Yb nuclear spin. Finally, simultaneous excitation of the $^1S_0 \rightarrow {}^3D_2$ two-photon transition (808 nm) and the $^1S_0 \rightarrow {}^3P_1$ single-photon transition (556 nm) can be used to generate a 1479 nm radiation field (resonant with the $^3D_2 \rightarrow {}^3P_1$ transition) through four- wave mixing. Experimental progress towards observing these processes will be presented.

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