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QUANTUM CONTROL OF LIGHT: From Slow Light and FAST CARS to Nuclear γ-ray Spectroscopy

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In recent work we have demonstrated strong coherent backward wave oscillation using forward propagating fields only. This surprising result is achieved by applying laser fields to an ultra-dispersive medium with proper chosen detunings to excite a molecular vibrational coherence that corresponds to a backward propagating wave [PRL, 97, 113001 (2006)]. The physics then has much in common with propagation of ultra-slow light. Applications of coherent scattering and remote sensing to the detection of bio and chemical pathogens (e.g., anthrax) via Coherent Anti-Raman Scattering together with Femtosecond Adaptive Spectroscopic Techniques (FAST CARS [Opt. Comm., 244, 423 (2005)]) will be discussed. Furthermore, the interplay between quantum optics (Dicke super and sub-radiant states) and nuclear physics (forward scattering of γ radiation) provides interesting problems and insights into the quantum control of scattered light [PRL, 96, 010501 (2005)].