Abstract Submitted
for the DAMOP08 Meeting of
The American Physical Society

Observation of Optical Precursors at the Biphoton Level SHENGWANG DU, CHINMAY BELTHANGADY, PAVEL KOLCHIN, G.Y. YIN, S.E. HARRIS, Edward L. Ginzton Laboratory, Stanford University, Stanford, CA 94305, USA — We report the first observation of optical precursors at the front edge of a biphoton wave packet, as measured by correlation of single photons. Optical precursors were first described by Sommerfeld and Brillouin in 1907, and are of importance in electromagnetic theory in that they resolve theoretical difficulties when group velocities are slow or fast as compared to c in vacuum. Here, we describe the quantum optical precursors in time-energy entangled biphoton wave packets generated using EIT in a two-dimensional 85Rb magneto-optical trap. The frequency components within the EIT window contribute to the biphoton main waveform as determined by the slow group velocity. The transient structure at the leading edge of the biphoton wave packet is a result of interference between two far-detuned frequency bands. This interference gives rise to the generation of a precursor field with a steep rising leading edge (Sommerfeld) followed by damped oscillations (Brillouin). A stationary phase approximation agrees well with the experimental results at optical depths between 30 and 62.

Shengwang Du
Edward L. Ginzton Laboratory, Stanford University

Date submitted: 30 Jan 2008 Electronic form version 1.4