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Progress towards number squeezing a weak coherence state using a Kerr nonlinearity based on Rydberg EIT DANIELA ANGULO MURCILLO, JOSIAH SINCLAIR, KYLE THOMPSON, AEPHRAIM STEINBERG, University of Toronto — Recent realization of a large, on-resonant cross-Kerr nonlinearity based on Rydberg atoms and electromagnetically induced transparency (EIT) provides a new platform for long-sought after applications of single-photon nonlinearities like photon-number squeezing, and quantum non-demolition (QND) measurement of photon number. We report on progress towards measurement-induced number squeezing for a weak coherent state. The experiment will involve two optical pulses, the probe and signal, which interact via a Rydberg-based Kerr medium. During the interaction, the probe acquires a phase shift proportional to the number of photons in the signal. After the interaction, the phase shift of the probe is measured. This act of observation on the probe is expected to reduce the variance in photon number on the signal, producing a weakly number-squeezed coherent state. To characterize this squeezing, we are in the process of upgrading our experimental setup to displace the signal state near the vacuum and measure its second order correlation function. This experiment will constitute a proof-of-principle demonstration of the utility of large Rydberg nonlinearities and marks progress towards QND measurement of photon number.

Daniela Angulo Murcillo
University of Toronto

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