Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Four-Wave Mixing in a Hot Sodium Vapor Cell in the Large Single-Photon Detuning Regime HIO GIAP OOI, QIMIN ZHANG, SAESUN KIM, ALBERTO MARINO, ARNE SCHWETTMANN, Univ of Oklahoma — Four-wave mixing (4WM) is a non-linear process that can produce correlated twin beams of light, which are useful for quantum-enhanced sensing and interferometry below the shot-noise limit. We are interested in generating entangled twin beams at 589 nm to enhance density measurements of our sodium Bose-Einstein condensate. We use 4WM in a double-lambda configuration in a hot sodium vapor cell to generate twin beams of light, known as probe and conjugate. While twin beams with a large degree of quantum correlations have been previously generated in rubidium via 4WM, this is not the case for sodium. Sodium has a smaller hyperfine splitting, such that the Doppler-broadened absorption lines overlap, which leads to a significant absorption for the twin beams when operating close to the resonant regime. To reduce the loss of photons, we operate our 4WM system in a large single-photon detuning regime where the frequency of the twin beams falls in a region of the spectrum where there is no absorption. This is done by adjusting the single-photon and two-photon detunings. We present our experimental progress and characterize the gain dependence on various experimental parameters.

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Date submitted: 31 Jan 2020 Electronic form version 1.4