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Frequency Tunable Squeezed Light through Atomic State Dressing of Four-Wave Mixing[1] SAESUN KIM, ALBERTO M. MARINO, University of Oklahoma — The reduced noise properties of squeezed light make it an ideal quantum state for quantum-enhanced metrology based on optical sensors. To extend its applicability to atomic-based sensors, squeezed light that can be tuned to and around atomic resonance is needed. While we have previously shown that it is possible to generate resonant two-mode squeezed light using four-wave mixing (FWM) in atomic Rb vapor, its tunabilty was limited by atomic absorption. To overcome this limitation, we have designed a vacuum chamber with internal electrodes that can be used to apply a large electric field to a rubidium vapor cloud. Our system can support electric fields of the order of 10 MV/m for a Rb number density of $\sim 10^{16}/\mathrm{m}^{-3}$, which leads to a DC stark energy level shift of 500 MHz for the D1 transition. Furthermore, for the number densities required for the FWM process ($\sim 10^{18}/\mathrm{m}^{-3}$) the system can support electric fields of the order of 7 MV/m. This allows us to tune the frequency of the squeezed light by as much as 250 MHz while preserving a level of 4dB of squeezing. This dressed energy level approach can also enable a tunable single-mode vacuum squeezed state source via polarized self-rotation and a tunable narrowband optical filter near atomic resonance.

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