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Phase-Sensitive Amplification by Four-Wave Mixing in an Atomic Vapor NEIL CORZO, ALBERTO MARINO, JEREMY CLARK, ANDREW LANCE, JQI, NIST and The University of Maryland, KEVIN JONES, Williams College and NIST, PAUL LETT, JQI, NIST and The University of Maryland — A phase-sensitive amplifier (PSA) is based on a parametric process that can amplify or deamplify a signal depending on the phase of the input. It does so without degrading the signal to noise ratio of the input, contrary to a phase-insensitive amplifier (PIA) which adds at least 3dB of noise to the signal in the limit of high gain. This makes it possible to obtain noiseless amplification of a signal, making it a key element in optical communication systems. For the particular case where the input signal's phase is chosen for maximum deamplification the PSA can generate squeezed light. We present an experimental realization of a phase-sensitive optical amplifier using a four-wave mixing interaction based on a double-lambda configuration in hot Rb vapor. We report nearly noiseless amplification for a range of gains as well as the generation of "single-beam" squeezing. We compare the results obtained with a theorical phase-insensitive scheme. The lack of a cavity in our system and relaxed phase-matching conditions can be used to observe noiseless amplification of multi-spatial-mode signals (i.e. images).

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