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Compact Source of Entangled Images and Squeezed Light Using Four-Wave Mixing in Rubidium Vapor RAPHAEL POOSER, ALBERTO MARINO, VINCENT BOYER, PAUL LETT, National Institute of Standards and Technology — Recently great interest has been generated in the quantum correlations and entanglement present in multi-mode squeezed fields, which have applications in quantum information, quantum imaging, and quantum computing. We use a nondegenerate four-wave mixing (4WM) process in Rubidium vapor at 795 nm to demonstrate generation of entangled images and multi-mode output beams. We have verified the presence of entanglement between the multi-mode beams by analyzing the amplitude difference and the phase sum noise using a dual homodyne detection scheme, measuring more than 4 dB of squeezing in both cases. This amount of squeezing also implies EPR correlations between the output beams. The multi-spatial-mode character of the entanglement is shown by using an arbitrarily shaped local oscillator during these measurements. Transferring the quantum correlations from the light to atoms in order to generate correlated atom beams is another interesting prospect. We have built a compact 4WM source of squeezed light, using semiconductor lasers only, for use in such experiments. We show that tapered amplifier lasers can be made to emit low enough input pump noise to the four wave mixing process to preserve the squeezing properties of the output beams.

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