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Experimental observation of spatial quantum noise reduction below the standard quantum limit with bright twin beams of light[1] ASHOK KUMAR, HAYDEN NUNLEY, ALBERTO MARINO, University of Oklahoma — Quantum noise reduction (QNR) below the standard quantum limit (SQL) has been a subject of interest for the past two to three decades due to its wide range of applications in quantum metrology and quantum information processing. To date, most of the attention has focused on the study of QNR in the temporal domain. However, many areas in quantum optics, specifically in quantum imaging, could benefit from QNR not only in the temporal domain but also in the spatial domain. With the use of a high quantum efficiency electron multiplier charge coupled device (EMCCD) camera, we have observed spatial QNR below the SQL in bright narrowband twin light beams generated through a four-wave mixing (FWM) process in hot rubidium atoms. Owing to momentum conservation in this process, the twin beams are momentum correlated. This leads to spatial quantum correlations and spatial QNR. Our preliminary results show a spatial QNR of over 2 dB with respect to the SQL. Unlike previous results on spatial QNR with faint and broadband photon pairs from parametric down conversion (PDC), we demonstrate spatial QNR with spectrally and spatially narrowband bright light beams. The results obtained will be useful for atom light interaction based quantum protocols and quantum imaging.

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