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Direct measurement of position-momentum entanglement in bright twin beams[1] ASHOK KUMAR, ALBERTO M. MARINO, University of Oklahoma — Entanglement is a key resource for quantum information processing and quantum metrology. In particular, entangling photons in their position-momentum degrees of freedom not only provides a test for the original Einstein-Podolsky-Rosen paradox but also offers a platform for parallel quantum information processing. Here we show the presence of position-momentum entanglement in bright twin beams of light, with a photon flux of the order of 10^{14} photon pairs per second, through measurements with an electron multiplying charge-coupled device (EMCCD) camera. We generate the bright twin beams with a four-wave mixing process in a hot rubidium vapor cell and record images of these beams in the near and far field with an EMCCD camera. These near and far field images provide information about spatial and momentum correlations of the photons, respectively. From the recorded images, we have measured squeezing levels of around 0.5 dB in the near field and 2 dB in the far field. The presence of sub-shot noise correlations in the spatial and momentum degrees of freedom demonstrates the quantum nature of the correlations.

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