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Transduction of Entangled Images by Localized Surface Plasmons[1] MOHAMMADJAVAD DOWRAN, MATTHEW HOLTFRERICH, University of Oklahoma, BENJAMIN LAWRIE, RODERICK DAVIDSON, RAPHAEL POOSER, Oak Ridge National Laboratory, ALBERTO MARINO, University of Oklahoma — Quantum plasmonics has attracted broad interest in recent years, motivated by nano-imaging and sub-wavelength photonic circuits. The potential for nanoscale quantum information processing and quantum plasmonic sensing has led to the study of the interface between quantum optics and plasmonics. We study the interface between continuous variable entangled images and localized surface plasmons (LSPs). We generate entangled images with four-wave mixing in hot Rb atoms. The entangled images are sent through two spatially separated plasmonic structures, which consist of an array of triangular nanoholes in a silver metal film designed to excite LSPs. After transduction through the plasmonic structure, mediated by extraordinary optical transmission (EOT), the entanglement properties of the light are characterized. We show that both the entanglement and spatial properties of the light are preserved by the LSPs. This results show that the transfer of entanglement and quantum information from multi-spatial mode photons to LSPs and back to photons is a coherent process that preserves the spatial quantum information of the incident light. By addressing two spatially separated plasmonic structures, the entanglement is effectively transferred to the plasmons for a short period of time.

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