

ENTANGLING NEAR-FIELD PHOTONS IN THEIR TOTAL ANGULAR MOMENTA



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Fundamentally, a photon carries spin, which is an intrinsic angular momentum, and orbital angular momentum (OAM), determined by the shape of its wavefunction. In paraxial optics, the two forms of angular momentum are separable, such that entanglement can be induced between the spin and OAM of a single photon or of different photons in a multi-photon state. In nanophotonic systems, however, the spin and OAM of a photon are inseparable, so what happens to the entanglement when such photons are launched into a nanophotonic system? Is the entanglement lost? Our recent work (to appear in Nature) addresses these questions, presenting the first observation of near-field photons entangled in their total angular momentum. These ideas pave the way for on-chip quantum information processing using the total angular momentum of photons as the encoding property for quantum information.