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# Engineering quantum states from a spatially structured quantum eraser

Quantum interference is a central resource in many quantum-enhanced tasks, from computation to communication protocols. While it usually occurs between identical input photons, quantum interference can be enabled by projecting the quantum state onto ambiguous properties that render the photons indistinguishable, a process known as a quantum erasing. Structured light, on the other hand, is another hallmark of photonics: it is achieved by manipulating the degrees of freedom of light at the most basic level and enables a multitude of applications in both classical and quantum regimes. By combining these ideas, here we design and experimentally demonstrate a simple and robust scheme that tailors quantum interference to engineer photonic states with spatially structured coalescence along the transverse profile, a type of quantum mode with no classical counterpart. To achieve this, we locally tune the distinguishability of a photon pair via spatial structuring of their polarisation, creating a structured quantum eraser. We believe these spatially-engineered multi-photon quantum states may be of significance in fields such as quantum metrology, microscopy, and communications.

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