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A New Quantum Eraser Using Hyperentanglement[1] HYUNG CHOI, DRAVEN HOUSER, DUSTIN SWARM, Greenville University — We propose a new type of quantum eraser using hyperentangled photon pairs. Whereas a typical quantum eraser makes use of photons that are entangled in a single quantum state, usually in polarization, our new quantum eraser exploits entanglements in both polarization and momentum states. In a typical quantum eraser one gains "which-path" information of one photon by changing the polarization measurement of the other. This results in "erasing" the interference pattern previously obtained through indistinguishability of paths. In our new quantum eraser we gain information about the momentum state of one photon by changing the polarization of the other photon in one of its momentum states. The knowledge of the momentum state then "erases" the interference pattern previously obtained in the coincident counts of the photon pairs. This new quantum eraser may readily be implemented using photon pairs produced by Type-I Parametric Down Conversion. To achieve extra entanglement in momentum states, we simply subject them to pass through two distinguishable sets of pinholes and then recombine them before they reach polarization detectors.

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