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Spatiotemporal optical vortices[1] NIHAL JHAJJ, ILIA LARKIN, ERIC ROSENTHAL, SINA ZAHEDPOUR, JARED WAHLSTRAND, HOWARD MILCHBERG, University of Maryland — We present the first experimental evidence, supported by theory and simulation, of spatiotemporal optical vortices (STOVs). A STOV is an optical vortex with phase and energy circulation *in a spatiotemporal plane*. Depending on the sign of the material dispersion, the local electromagnetic energy flow is saddle or spiral about the STOV. STOVs are shown to be a fundamental element of the nonlinear collapse and subsequent propagation of short optical pulses in material media. STOVs conserve topological charge, constraining their birth, evolution, and annihilation. We measure a self-generated STOV consisting of a ring-shaped null in the electromagnetic field about which the phase is spiral, forming a dynamic torus that is concentric with and tracks the propagating pulse. Our results, here obtained for optical pulse collapse and filamentation in air, are generalizable to a broad class of nonlinearly propagating waves.

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