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Generation and Applications of Femtosecond Optical Vortices[1]

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An optical vortex is a singularity point in a (scalar) electric field where the amplitude vanishes and the phase is undetermined. Laguerre-Gaussian modes are examples of modes containing an optical vortex. Our interest in vortex modes stems from the fact that their photons possess optical orbital angular momentum (OAM).[2] Our goal is to make strong ultrashort pulses with a vortex, so we can study the influence of optical OAM on intense-field ionization. Our motivation is the role of the photon's *spin* angular momentum: in its manifestation as polarization, this affects intense-field ionization. Notable are electron recollision processes, central to many schemes to generate attosecond pulses. What role optical *orbital* angular momentum plays in intense-field processes is to the best of our knowledge experimentally unexplored territory. In 2005, we were the first to report the generation of a pure femtosecond vortex.[3] Our setup uses holographic diffraction and properly deals with bandwidth (tens of nm). We now use a programmable hologram.[4] We are currently increasing the intensity of our fs vortices to reach ionization levels so we can image focused vortices with our spatially-resolved ion detector. Recent progress will be discussed. Refs: [2]Allen L *et al.* 2003 *Optical Angular Momentum* (Bristol: IoP Publ.); [3]Mariyenko I *et al.* 2005 *Opt. Expr.* **13** 7599; [4]Strohaber J *et al.* 2006 *J. Phys B.* subm.

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