Abstract Submitted
for the 4CF17 Meeting of
The American Physical Society

Observing the Birth and Splitting of Optical Vortices Through Phase-Stepping Interferometry WILLIAM G. HOLTZMANN, Univ of Denver, FABIO DASILVA, NIST Boulder, MARK E. SIEMENS, Univ of Denver — "Twisted" light beams contain photons with Orbital Angular Momentum (OAM), given as $\ell\hbar$ per photon by Allen et al. where ℓ is an integer, and are characterized by a helical wavefront. When all of the photons carry the same value of OAM, the beam will have an optical vortex in its center which has a topological charge equal to ℓ. However, when a light beam carries a superposition of OAM values, there will generally be multiple optical vortices with varying topological charges. We use a near-field imaging system capable of imaging a light beam on the surface of a forked diffraction grating, which imparts OAM onto the first order diffracted beam, to observe the birth and movement of these optical vortices. Additionally, we use a phase-stepping interferometry technique to fully measure the phase of the light beam immediately after passing through the forked grating. In this technique, the transmitted beam through the grating is phase controlled by adjusting its path length through a piece of glass before interfering it with the first order diffracted beam. This is done for at least four different phase steps, and then we use the acquired images to calculate the phase of the light beam, allowing for a full characterization of the beam in the near-field.

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Date submitted: 20 Sep 2017 Electronic form version 1.4