Holographic Generation and 3-D Ion Imaging of Focused Ultra-short Pulses of Complex Light\textsuperscript{1} JAMES STROHABER, CHAD PETERSEN, CORNELIS UITERWAAL, Univ. Nebraska - Lincoln (cuiterwaal2@unl.edu) — We investigate an open question in intense-field physics: are excitation and ionization with ultrashort pulses affected by optical orbital angular momentum (OAM)? To answer this question, we holographically create Laguerre-Gaussian paraxial modes, which carry optical OAM. In our experiments we use a computer-controlled spatial light modulator to modulate the transversal profile of 50-fs, 800-nm pulses. Using phase-only masks that also encode the amplitude profile of the desired mode we create \textmu m-sized foci of complex light. We analyze the mode purity of our foci on-site by imaging them with ions, which act as local intensity sensors. We obtain three-dimensional images of the foci without requiring assumptions about their geometry. We also use ion imaging to realize a photo-dynamical test tube, by recording ions created in the ‘hottest’ spot of the focus only, with unsurpassed \textmu m resolution. This allows us to study ionization processes without having to integrate yields over the whole focal region. Finally, we also present a new set of steady-state modes in quadratic lenslike media; these modes are separable solutions in cylindrical parabolic coordinates. Recent progress will be discussed.

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