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Two-Dimensional Electron and Metastable Density Profiles Produced in Helium Fast Ionization Wave Discharges[1] BRANDON WEATHERFORD, EDWARD BARNAT, Sandia National Laboratories, ZHONGMIN XIONG, MARK KUSHNER, University of Michigan — Fast ionization wave (FIW) discharges are those in which nanosecond-duration pulses at high overvoltage are used to initiate large volume breakdown at elevated pressures. This presentation summarizes recent studies of spatial distributions of electron and metastable production in a helium FIW discharge. Two-dimensional laser collision-induced fluorescence (2D-LCIF) is used to generate spatially and temporally resolved maps of electron and metastable densities produced by a FIW with positive polarity pulses of >10 kV, with 20 ns duration and ∼3 ns rise time. The results show that radial profiles depend strongly on operating pressure (1-20 Torr) and pulse repetition rate (0.2-2 kHz); these trends are discussed and correlated with measured FIW propagation velocities and estimates of the effective reduced electric field (E/N) in the FIW wavefront. Differences between the electron and metastable profiles are related to the uniformity of energy deposition in FIWs. Results from a two-dimensional computational model are presented, which capture similar trends as those seen in experiment. A comparison between experimental and modeling results is discussed to provide additional insights into the physical processes behind FIW propagation.

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