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The Role of Initial Metastables in Discharge Evolution[1]
MATTHEW HOPKINS, NICHOLAS ROBERDS, GEORGE NAIL, EDWARD BARNAT, Sandia National Laboratories — The evolution of a discharge process in a repetitively discharged system of atomic gas can be complicated due to the presence of unknown amounts of metastable neutral atoms. This is due to the lower ionization energies required for a metastable atom than a ground state one. To better understand the change in discharge behavior of such a repetitively discharged system we investigate the role of initial metastable populations in discharge. If there is a sufficient initial metastable population, then the transient behavior of the discharge, and indeed perhaps the existence of a discharge at all, can be strongly influenced. The work presented here aims to demonstrate the effects of different initial metastable populations, and identify the different discharge modalities (e.g., faster initiation) by simulating moderate pressure 1D helium discharges in the Particle-in-Cell Direct Simulation Monte Carlo code, Aleph. The change in Paschen curves due to the presence of different densities of metastable atoms will be explored. Finally, comparisons to experimental results will also be shown.

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