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A Statistical Photon Transport Model: Application to Streamer Discharges in Dry Air[1] ZHONGMIN XIONG, MARK J. KUSHNER, University of Michigan — Photon transport and photo-ionization are necessary to advancing propagation of positive streamer discharges by providing seed electrons. Although plasma hydrodynamics may be well represented by local transport, photon transport is intrinsically non-local. On short time and spatial scales, photon transport may also be statistical which in turn may be partly responsible for streamer branching. In this paper we discuss results from a computational investigation of the consequences of statistical radiation transport and photoionization on streamer propagation. Radiation transport in *nonPDPSIM,* the model for this study, uses a continuum approach in which photon flux from each emitting node is isotropic and every node within its absorption length receives flux. In reality, during any given time step photon emission may not be large enough for every node to receive a photon. To better reflect the statistical nature of photon transport, the emitted photon flux was discretized into particle-like packets which are isotropically but randomly emitted within a given solid angle. The time averaged flux is isotropic and all nodes within the absorption sphere receive flux, but in a statistical manner which allows for statistically long mean-free-paths. This model has been applied to simulations of positive streamer discharges in atmospheric-pressure, dry air with ns rise time voltage pulses. The results demonstrate that the statistical nature of photon transport producing stochastically distributed seeds of preionization, can be responsible for the branching of positive streamers.

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Mark J. Kushner
University of Michigan

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