

Simulation of streamer initiation using a Particle in cell code with Monte Carlo collisions. Application to sprite ignition.

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An interesting axe of studies in sprite research is to have a better understanding of its ignition. It is thought that sprite small-scale structures are streamers. And, from high-speed video observations, streamers are seen to precede sprite. In order to study sprite ignition, computer simulation gives us a powerful tool. This talk will present a particle code that is under development to have small-scale simulations describing the kinetic of electrons in the streamer formation. The method employed is a classical Particle in Cell method plus Monte Carlo treatment of collisions. The particles are followed inside a Cartesian mesh, collision processes are performed randomly accordingly cross-sections and the self-consistent electric field is calculated. The key parameters for gas discharge (electron mobility, ionisation coefficient, etc.) and every considered collisional event rates are calculated internally and do not need other assumption nor model. At present, our code uses 2D axisymmetrical coordinates and is designed to run in a parallel computing environment. The code can simulate 3D development of an electron avalanche, its transition into a streamer and the beginning of the streamer propagation until its branching point (**Figure 1**). It contains a model of photoionisation, which enables to have positive streamer propagation as well as negative one (**Figure 2**). The code can recover useful information on creation rates of excited neutrals that enables to calculate optical emissions for comparison of simulation results with observations. Some results of streamer development and optical emissions under atmospheric condition of sprite ignition will be presented.

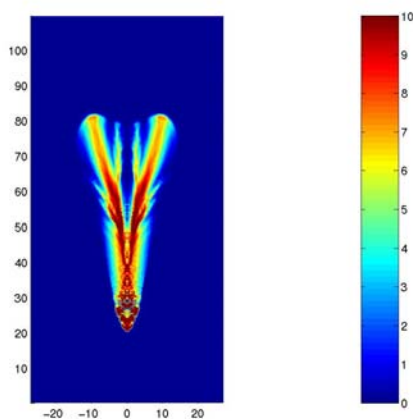


Figure 1: Simulation of negative streamer branching.

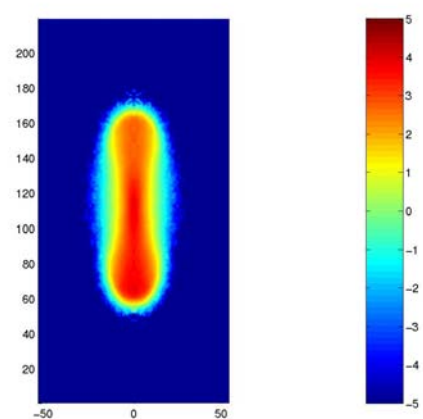


Figure 2: Simulation of negative and positive streamer propagation.