



Production of runaway electrons in electric discharges and their impact on branching

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The discovery of bursts of X- and γ -rays from the atmosphere above thunderstorms has raised new questions relating to the electric discharge process. The bursts of radiation are thought to be generated by bremsstrahlung from energetic electrons accelerated in electric discharges of the thunderstorm. To study the production of such high energy electrons in conventional (thermal) discharges a particle in cell with Monte Carlo Collision (PIC-MCC) code is used. A 2D cylindrical version of the code allows simulating streamer discharges until a time when the first runaway electrons appear. High energy electrons are seen to create ionization trails of ionization ahead of the streamer which stimulate its branching. In order to improve the precision of the number of runaway electron inside the streamer tip, a 1D version of the code with improved particle resolution in the high energy range is used. It allows calculating the probability for electrons to have energies above the runaway threshold. It is found that the probability of generating runaway electrons is significant even for modest field in the streamer tip.