



Air density perturbations as a source of X-rays from streamer discharges

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The density of the ambient gas medium plays an important role in the streamer propagation since the gas serves as a source for free electrons from ionisation and also limits the electron acceleration by inelastic collisions. We explore the dynamics of streamer propagation and associated X-ray production in air with density perturbations at scales comparable to streamer dimensions. Simulations are conducted with a 2.5D cylindrical Monte Carlo particle code of streamers initiated in air with densities perturbed perpendicularly to the ambient electric field. We show that streamers initiated in density troughs can stimulate electron acceleration to several tens of keV with subsequent production of X-rays through the bremsstrahlung process. Our results underscore the complexities of the leader-streamer process and of the processes that seed run-away electron avalanches and X-rays in discharges.