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2d axisymmetric ”beam-bulk” modelling of the generation of runaway electrons by streamers.

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We present results from a 2d axisymmetric numerical model of streamers based on a “beam-bulk” approach which describes cold electrons with a fluid model and high energy electrons with a particle model.
The interest is motivated by the generation of runaway electrons by streamers which may participate in the recently observed TGFs and which challenge the modelling. Runaway electrons are known to be generated from streamers when the electric field in its negative tip is of sufficient magnitude. After overtaking the streamer tip, runaways can affect the streamer propagation ahead and may produce high energy photons through the bremsstrahlung process. In conventional model of streamers, the evolution of the streamer discharge is mostly governed by cold electrons. By including runaway electrons, we model their production, their impact on the discharge propagation and can address their role in TGFs.
Results of streamer propagation in leader electric field show that the runaway electrons accelerate the streamers, reduce the electric field in its tip and enlarge its radius by pre-ionizing the gas ahead. We observed that if we increase the electric field, the discharge is getting more diffuse, with a pattern driven by the increase in runaway induced ionisation.