

EGU21-15358

<https://doi.org/10.5194/egusphere-egu21-15358>

EGU General Assembly 2021

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



Progress in modeling streamer and leader discharges

Ute Ebert, Dennis Bouwman, Hani Francisco, Baohong Guo, Xiaoran Li, Hemaditya Malla, Andy Martinez, and Jannis Teunissen

CWI, MD, Amsterdam, Netherlands (ute.ebert@cwi.nl)

We present recent progress in pulsed discharge modeling in Amsterdam that is motivated by high voltage and plasma engineering and by lightning.

We perform streamer simulations with adaptive mesh refinement in 2D and 3D using PIC particle models and fluid models, where we now can include complex electrode shapes and dielectric boundaries. For the longer time evolution, we also have added Ohmic heating, gas expansion, and the relevant plasma chemistry for air and methane-air mixtures.

Results relevant for lightning physics include

- Validation and verification of streamer propagation models (with S. Dijcks and S. Nijdam for the experimental counterpart)
- Simulations of streamer branching and comparison with experiments
- Parameter studies for long non-branching streamers that can accelerate or decelerate, and vary largely in velocity, radius and inner electron density, depending on the electric field
- Different stagnation behavior of positive and negative streamers in low electric fields
- Positive streamers in air that can continue to propagate as isolated patches of positive charge, without a conducting channel behind the streamer head
- Repetitive discharges, heating, and plasma-chemistry