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ROLE OF PHOTON PROCESSES IN THE RF BREAKDOWN OF AIR*

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The behavior of the breakdown in air at RF frequencies for different gap lengths has been studied numerically at atmospheric pressure. The focus here is on gap lengths in the 1–5 mm range. A numerical analysis based on Monte Carlo calculations as discussed previously [1] is applied, with explicit inclusion of photon processes. The simulation results are compared with experimental data obtained within our group on RF breakdown in air at atmospheric pressure. The inclusion of photon-assisted charge growth through the photoemission process, is shown to serve as a delayed but continuous sources of electrons. This works to effectively lower the breakdown threshold, especially in geometries consisting of large area electrodes separated by short gaps, much smaller than the electrode areal dimensions.

The simulated predictions match the breakdown data quite well for the tested gap lengths. In addition, frequency-dependent breakdown fields are also obtained through the Monte Carlo calculations. A general U-shaped characteristic with frequency results. These trends as well as other features of the RF breakdown, with the important role of photons, will be presented and discussed.

[1]. H. Nguyen, J. Mankowski, J. C. Dickens, A. A. Neuber, and R. P. Joshi, "Model Predictions for Atmospheric Air Breakdown by Radio-Frequency Excitation in Large Gaps," Physics of Plasmas, vol. 24, 073505 (2017).

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