Abstract Submitted
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Simulation of electron interactions with liquid water and processes related to sub-nanosecond electrical breakdown[1] TOMAS HODER, PETR BILEK, Masaryk University, Brno, Czech Republic, MILAN SIMEK, Institute of Plasma Physics, CAS, Prague, Czech Republic, ZDENEK BONAVENTURA, Masaryk University, Brno, Czech Republic — Sub-nanosecond electrical breakdown in dielectric liquids is of vital interest, e.g. for applications in high-voltage insulation and high-current switching. Liquid dielectrics in strong nonuniform electric fields are under influence of electrostrictive force that tends to move the fluid into the regions with higher electric field. If the voltage rise is fast enough, the liquid does not have enough time to be set into motion in order to reduce the internal stress. In this case the ponderomotive force induces significant stress in the bulk of the liquid which is manifested as a negative pressure. At certain threshold, the negative pressure causes cavitation ruptures of the fluid. Subsequently, free electrons can be produced by emission from the surface inside the cavity and accelerated to energies exceeding the energy for ionization of water and contribute to ultrafast electrical breakdown of water. In this work we investigate conditions under which appearing cavitation nanopores will expand and we will determine their size at the end of the fast voltage pulse, in order to get an estimation of energy that can an electron gain being accelerated in the void.

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Tomas Hoder
Masaryk University

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