Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Pulsed Picosecond and Nanosecond Discharge Development in Liquids with Various Dielectric Permittivity Constants ANDREY STARIKOVSKIY, MICHAEL SHNEIDER, Princeton University — The dynamics of pulsed picosecond and nanosecond discharge development in liquid water, ethanol and hexane were investigated experimentally. Three possible mechanisms for the propagation of discharge in liquids play a different role depending on the pulse duration. The first case takes place when a "long" (microsecond) electric pulse applied in a non-conducting fluid: as a result of electrostatic repulsion, the formation of low density channels occurs. Consequently, the discharge propagates through the low-density regions. In the second case, under an "intermediate" (nanosecond) electric pulse conditions, the electrostatic forces support the expansion of nanoscale voids behind the front of the ionization wave; in the wave front the extreme electric field provides a strong negative pressure in the dielectric fluid due to the presence of electrostriction forces, forming the initial micro-voids in the continuous medium. Finally, in the third case, when a "short" (picosecond) electric pulse is utilized, the regions of reduced density cannot form because of the extremely short duration of the applied electric pulse. Ionization in the liquid phase occurs as a result of direct electron impact without undergoing a phase transition, occurring due to the acceleration of electrons by an external electric field comparable to the intra-molecular fields. The discharge propagates with a velocity comparable to the local speed of light.

Andrey Starikovskiy
Princeton University

Date submitted: 19 Jun 2015 Electronic form version 1.4