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Pulsed Nanosecond Discharge Development in Liquids with Various Dielectric Permittivity Constants ANDREY STARIKOVSKIY, Princeton University, PU TEAM — The dynamics of pulsed nanosecond discharge development in liquid water, ethanol and hexane were investigated experimentally. High-voltage pulses with durations of 20 and 60 ns and amplitudes of 6-60 kV were used for discharge initiation. It is shown that the dynamics of discharge formation fundamentally differ between liquids with low and high dielectric permittivity coefficients. In water (high permittivity), two phases were observed in the process of the discharge development. The first phase is connected with electrostriction compression of the media near the needle tip and the formation of a rarefaction wave in the surrounding liquid. The second phase (the discharge phase) has a pronounced start delay, which depends on the voltage of the high-voltage electrode. Unlike in water, the first phase is essentially non-existent in liquids with low dielectric permittivity coefficients because of the small electrostriction forces and the low intensity of the rarefaction wave that is formed. The second phase in the process (discharge) begins at significantly higher voltages on the high-voltage electrode, immediately leading to the long branched structure of the streamer-leader flash.

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