Abstract Submitted
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Nanosecond Repetitively Pulsed Discharges in Air at Atmospheric Pressure – Experiment and Theory of Regime Transitions[1] DAVID PAI, DEANNA LACOSTE, CHRISTOPHE LAUX, Ecole Centrale Paris, LABORATOIRE EM2C UPR288 TEAM — In atmospheric pressure air preheated from 300 to 1000 K, the Nanosecond Repetitively Pulsed (NRP) method has been used to generate corona, glow, and spark discharges. Experiments have been performed to determine the parameter space (applied voltage, pulse repetition frequency, ambient gas temperature, and inter-electrode gap distance) of each discharge regime. Notably, there is a minimum gap distance for the existence of the glow regime that increases with decreasing gas temperature. A theory is developed to describe the Corona-to-Glow (C-G) and Glow-to-Spark (G-S) transitions for NRP discharges. The C-G transition is shown to depend on the Avalanche-to-Streamer Transition (AST) as well as the electric field strength in the positive column. The G-S transition is due to the thermal ionization instability. The minimum gap distance for the existence of the glow regime can be understood by considering that the applied voltage of the AST must be lower than that of the thermal ionization instability. This is a previously unknown criterion for generating glow discharges, as it does not correspond to the Paschen minimum or to the Meek-Raether criterion.

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