Investigation of the impact of the photoionization on negative and positive corona discharges

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***Abstract* — A numerical study of the positive and negative corona discharge in air incorporating the photoionization phenomenon will be presented in the proposed paper. The studied model consists of a 2D axi-symmetric representation of a needle-plane geometry for both polarities of the applied high voltage. The considered numerical model consists of three drift-diffusion equations (modelling the motion, generation and dissipation of charged species), one Poisson equation (calculating the electric field), and three Helmholtz equations (modelling the electrons produced due to photoionization). The results were in acceptable agreement with the experimental results. Some justifications are suggested for the discrepancies between simulation and experimental results. For the purpose of studying the relative importance of the photoionization compared to the impact ionization, some new insights were demonstrated by introducing the ratio of the Integral of the Impact ionization Source term (IIS) divided by the Integral of the Photoionization Source term (IPS). According to the simulation results, it is suggested that comparing the number of electrons produced from each source does not give a complete picture of the importance of the different electron sources and their spatial distribution should be considered as well.**