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# MODELING OF TOWNSEND DISCHARGES AT HIGH E/N AND LOW PRESSURE

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**Abstract.** Nonequilibrium manifestations in electron and heavy particle transport in gaseous discharges are standard part of all devices that uses such a plasma. Nonequilibrium effects are related to collective behavior of these particles in gas that deviates from the hidrodynamic regime. In that sense phenomena presented in this work are part of the swarm physics for which it is characteristic that particles do not interact with particles of the same kind but only with the unpertrbed background gas particles. Only partial information is avaliable on elementary collisional processes that are important for modelling of gas discharges. As a result all the research on gas discharges is to a large degree conected to the fundamental studies in atomic and molecular physics.

Aim of this work is to investigate complex behavior of electrons and ions by the most precise possible method - Monte Carlo simulations. Although recognized as a relatively simple for implementation it is, at the same time, difficult to test and verify. In any case, this method is revealed as a right choice for modelling of Townsend discharges. This work begins with selection of input data and benchmarking of the codes. Main results are modelling of Townsend discharges in nitrogen and argon at low pressures and at consequently at very high E/N. We include description of effects of ions and fast neutrals to kinetics of excitation, description of nonhydrodinamic effects in the vicinity of electrodes and at the high E/N the runaway of electrons and ions. We also present description of impulse discharges and time resolved current impulses under similar conditions. In addition we have compiled cross section sets that may serve for discharge modelling in argon and nitrogen in broad range of conditions and discussed numerous approximations that were recently used in modelling of plasmas.