NONLINEAR TRANSPORT IN GASES, TRAPS AND SURFACES

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Abstract. We will present our numerical study of three different charge transport processes and we will compare properties, specially the nonlinearity, of these processes. First process is electron transport in gases in swarm regime. We used well tested Monte Carlo techique to investigate kinetic phenomena such as negative diferencial conductivity (NDC) or negative apsolute mobility (NAM). We explain these phenomena analysing the spatial profiles of the swarm and collision events.

In the second part we will apply the same technique on positron transport to obtain the same level of understanding of positron transport as has been achieved for electrons. The influence of positronium formation, non-conservative process, is much larger than any comparable effects in electron transport due to attachment and/or ionisation. As a result several new phenomena have been observed, such as NDC for the bulk drift velocity. Additionaly, the same Monte Carlo technique is used for modeling and optimisation of Surko like positron traps in different geometries and field configurations.

Third process we studied is the charge transport under voltage bias via single-electron tunnelings through the junctions between metallic particles on nanoparticle films. We show how the regular nanoparticle array and topologically inhomogeneous nanonetworks affect the charge transport. We find long-range correlations in the time series of charge fluctuation at individual nanoparticles and of flow along the junctions within the network. These correlations explain the occurrence of a large non-linearity in the simulated and experimentally measured current–voltage characteristics and non-Gaussian fluctuations of the current at the electrode.

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