Study of microfield statistical properties by using multi-component plasma Molecular Dynamics simulation.

Calisti A.[1], Ferri S.[1], Talin B.[1]

[1]CNRS, Aix Marseille Univ, PIIM, Marseille F-13397, France

For various purposes, it is necessary to simulate virtual plasma composed of electrons and ions in different ionization states. Depending on the plasma conditions, it is required to account, in the simulations, for bound states as well as quantum mechanical processes to create and destroy them. This permits to avoid non-physical Coulomb collapse and to extend the applicability of classical MD simulations, which are ideally suited for fully-ionized, non-degenerate plasma, to a widest range of plasma conditions.

For this purpose, we have chosen to simulate the ions and electrons as interacting classical particles and to incorporate some quantum information through a regularized potential allowing to model collisional ionization and recombination processes. The BinGo-TCP code has been designed to deal with neutral mixtures composed of ions of the same atom with different charge states and electrons [1, 2]. Within the limits of classical mechanics, all charge-charge interactions are accounted for in the particle motion.

Characterizing properly, the local electric fields produced by the electrons and ions of the plasma, is very important for spectroscopic diagnostics as they interact with the emitters and modify the radiated spectra. These fields, which derived from the force calculations on individual charges, can be measured by accounting for all the interactions between charges. The TCP simulation is well designed to obtain time sequences of electric field. These can be used in the resolution of the Schrödinger equation describing the time evolution of the emitter wave functions in the time-dependent field, or to infer microfield statistical properties [3].

The discussion here, will be based on a statistical analysis of the microfields at charged points in terms of field distribution and field correlation functions, characterizing the contributions of ions or electrons or both (total).

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