LisbOn KInetics

PLASMA SCHOOL
Bad Honnef

XXIII[rd] International School on
Low Temperature Plasma Physics: Basics and Applications

Modeling Workshop

Hands on a Boltzmann solver

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Electrons are the prime species to convey energy into a gas, producing plasma. The study of low-temperature plasmas entails a description of the electron transport and interactions with neutral/charged species, for which either electron–neutral scattering cross sections or electron parameters or both are typical data required. Electron parameters can be obtained by averaging different quantities involving the electron-impact cross sections over the electron energy distribution function (EEDF), whose determination is therefore of paramount importance. The goal of this modeling workshop is to allow students to perform actual calculations of EEDFs, by solving the electron Boltzmann equation (EBE) under different working conditions.

The workshop will depart from the concepts presented in the lecture "Electron kinetics in atomic and molecular plasmas"

- to present the methodology adopted in the numerical solution of the EBE
- to identify the input data and parameters required for its solution
- to use the LisbOn Kinetics Boltzmann solver (LoKI-B) that solves a time and space independent form of the two-term EBE, for non-magnetized non-equilibrium low-temperature plasmas excited by DC/HF electric fields from different gases or gas mixtures, using electron scattering cross sections obtained from the open-access website LXCat (http://www.lxcat.net/).

LoKI-B is developed with flexible and upgradable object-oriented programming under MATLAB®, and is available as open-source tool (https://github.com/IST-Lisbon/LoKI), licensed under the GNU general public license.

Attendees will be given the opportunity to perform a series of exercises, analyzing the evolution of the EEDF in different atomic and molecular gases, with variations in the applied electric field (amplitude and frequency) and/or in the populations of vibrationally / rotationally excited states. A comparison between calculated and measured swarm parameters will also be proposed. The workshop is very interactive, with plenty of questions / discussions taking place, focusing on both physical and numerical features.

The workshop is limited to 10 students, preferable in the first year of a PhD thesis, to be divided into 5 groups of two, each group needing a computer (PC or MAC) with an installation of MATLAB® (version R2017b or any later version).