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Solving the Boltzmann equation for electrons in weakly ionized gases

LEANNE PITCHFORD, LAPLACE, Univ Toulouse and CNRS

Technologies based on low-temperature plasmas (LTP's) are ubiquitous in today's society, and modeling has played an important role in the development and optimization of many. LTP's are generated most simply by applying a voltage across two electrodes separated by a gas gap. Because of their relatively light mass, electrons are easily accelerated in electric fields and the electron "effective temperature" is much higher than that of the ions or the neutrals. Data needed for fluid models of LPT's include electron transport and rate coefficients, which are various energy moments of the electron energy distribution function (eedf). The eedf is generally nonMaxwellian and is determined by solving the Boltzmann equation for electrons, input to which is a complete set of electron-neutral scattering cross sections. The availability and quality of these cross sections are factors determining the accuracy of the solution. Additional factors determining the accuracy of calculated eedf's are the assumptions used in the solution technique. This presentation will include a discussion of approximations commonly used for solving the Boltzmann equation. The question of parameterization of transport and rate coefficients for use in fluid models will also be discussed. A brief description of the LXCat project (www.lxcat.net), a community-wide project aimed at making data for modeling LTP's available on-line, will be presented in the conclusions.