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Transport in low-pressure plasmas: from microelectronics to space exploration

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Low-pressure plasma discharges are used in many applications due to their ability to produce both reactive species at room temperature and highly directed energetic ions. However, the fundamental processes occurring in these complex non-equilibrium media, interacting with surfaces, are not yet well understood, and active research is still ongoing. Numerical simulations of low-pressure plasma reactors at a microscopic level are often not possible due to computer resources, and consequently it is necessary to provide simplified models. These models are constructed from first principles, to describe the global behaviour of industrial systems like plasma etching reactors used in microelectronics or plasma thrusters used for space exploration. The modelling problem may be separated in two parts: (i) how is the plasma sustained and therefore how electrons gain energy from electromagnetic fields (heating), and (ii) how do the charged particles move and transport to the reactor walls where they are lost (transport and/or confinement). This talk will treat the second point and give an overview of the progress made in the last decades. There will be a focus on the research carried out recently on plasma thrusters, and on the effect of the magnetic field on plasma transport.