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Self-consistent kinetic study of abnormal glow discharge plasmas
FLORIAN SIGENEGER, DETLEF LOFFHAGEN, INP Greifswald, F.-L.-Jahnstr. 19, 17489 Greifswald, Germany — The axial structure of abnormal glow discharge plasmas is analysed by means of a self-consistent hybrid approach. The investigations have been performed in plane parallel geometry for inert gases at pressures of some Torr. This approach couples the solution of Poisson's equation and a fluid description of electrons, ions and excited atoms with a kinetic treatment of the electron component. The system of Poisson's and time-dependent fluid equations is solved by a semi-implicit method. Using the electric field course determined from Poisson's equation and the excited atom densities from the fluid equations, the space-dependent electron Boltzmann equation is solved. This approach avoids the separation in fast and slow electrons and yields the axial profiles not only of rate coefficients but also of the transport coefficients. Starting from a space-independent electric field, the fluid and kinetic parts of the model are iteratively solved until a stationary state is reached. The results show a distinct separation between the cathode fall with a strongly decreasing electric field and the negative glow with a very low or even reversed electric field. The pronouncedly non-local behaviour of the electrons in this strongly changing field results in remarkable spatial alterations of their collision rate and transport coefficients.

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