Constriction of the positive column glow discharge in inert gases

Golubovskii Yu B[@] and Siasko A V

Saint-Petersburg State University, Universitetskaya Naberezhnaya 7/9, Saint-Petersburg 199034, Russia

[@] yu_golubovski@yahoo.com

The work is devoted to the experimental and theoretical study of the role of thermal, kinetic and radiation processes in constriction of the positive column of a glow discharge in argon, neon, and helium at gas pressures of tens and hundreds of Torr and currents of tens and hundreds of milliamps.

Over more than a century of research into this phenomenon, various points of view on the nature and mechanisms of positive column constriction have been formed. Among the main mechanisms that can lead to constriction, one can point out a thermal mechanism associated with the inhomogeneous heating of a neutral gas, leading to a redistribution of the neutral particles over the volume and, thus, to a change in the magnitude of the reduced electric field, as well as a kinetic mechanism associated with the formation features of the electron distribution function due to competition of electron-atom and electron-electron collisions. Until now, there is no unified point of view on the role of one or another mechanism in discharge constriction. In addition, the role of resonance radiation transport during discharge constriction was not previously discussed. A particularly fundamental issue is the radical difference in the mechanisms of constriction in neon and argon, on the one hand, and in helium, on the other hand, despite the visual similarity of the observed phenomena in these gases.

The work was supported by the RSF grant No. 22-12-00002.