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Enhanced Plasma Transport due to Neutral Depletion[1] AMNON FRUCHTMAN, GENNADY MAKRINICH, Holon Academic Institute of Technology, PASCAL CHABERT, JEAN-MARCEL RAX, LPTP, Ecole Polytechnique — The dynamics of plasma and neutral-gas in pressure balance are solved self-consistently to reveal the impact of neutral depletion. Analytical relations that determine the electron temperature, the rate of ionization, and the plasma density are derived. For the governing non- linear diffusion equation an analytical solution in the form of Kepler's equation is found. A generalized Schottky condition is derived in which the total number of neutrals, rather than the Paschen parameter, controls the electron temperature. It is shown that even if the plasma is weakly- ionized (typically 1%), neutral depletion dramatically modifies the discharge equilibrium. Due to the inherent coupling of ionization and transport, an increase of the energy invested in ionization can nonlinearly enhance the transport process. We show that such an enhancement of the plasma transport due to neutral depletion can result in an unexpected *decrease* of the plasma density when power is *increased*, despite the increase of the flux of generated plasma.

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