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Transition from weakly to strongly magnetized gas discharge plasma VALERY GODYAK, Osram Sylvania, NATALIA STERNBERG, Clark University — A study of the fluid model for cylindrical weakly ionized quasi- neutral plasmas in an axial magnetic field is presented. The model takes into account ionization, ion and electron inertia, as well as frictional forces for ions and electrons. The behavior of the plasma parameters for arbitrary magnitudes of the magnetic field, arbitrary gas pressure and plasma size is presented, making the model applicable for a wide range of discharge conditions. A magnetic field parameter is introduced, which specifies a parameter range for the magnetic field, gas pressure and plasma size where the Boltzmann equilibrium with the ambipolar field for the electron distribution is satisfied. In addition, a parametric relation for the magnetic field, gas pressure and plasma size is obtained, which separates the region of weak magnetic field effects from the region of strong magnetic field effects. For strongly magnetized plasmas, an asymptotic solution with non-zero plasma density at the plasma boundary is presented. Analytical approximations for the ionization frequency and the plasma density at the plasma boundary are found for arbitrary external discharge parameters. The theoretical results are supported by numerical computations.

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