STRUCTURE AND WALL FLUXES OF LOW-PRESSURE, MAGNETIZED PLASMAS IN CYLINDRICAL AND ANNULAR GEOMETRIES*

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The stationary structure of one-dimensional plasmas confined by an axial magnetic field and a cylindrical vessel has been analyzed in references 1 and 2 in terms of the different plasma lengths: vessel radius, electron gyroradius, Debye length, electron-skin depth, and electron-mean free path. In the magnetized, zero-Debye length limit, it consists of a the bulk-diffusive region, a thin quasineutral inertial layer, and the Debye sheath. Taking into account that a large magnetic confinement increases much the Debye length near the wall, the first part of the presentation discusses the non-zero Debye-length effects on the plasma structure and the fluxes of particles and energy to the wall.

The annular case of the same plasma problem was introduced in reference 3. The second part of the presentation pursues a detailed parametric analysis in terms of main plasma lengths. Emphasis is put on the balance of the forces determining electron momentum equilibrium (electric and magnetic forces, and pressure gradient); particle and energy fluxes to inner and outer wall; induced-field effects for non-zero beta plasmas; and asymmetries for a high ratio of the vessel radii. The applicability of the fluid Bohm condition to this magnetized problem will be discussed.


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