Investigation of low-pressure ion cyclotron range of frequencies discharge in a self-consistent formulation

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A self-consistent model of a low-pressure ion cyclotron range of frequencies discharge in a self-consistent formulation is constructed. The model includes Maxwell's equations rearranged to a system of elliptic equations for the squares of the moduli of the electric E and magnetic H strengths [1, 2], the electron balance equation and the electron energy conservation equation. Transfer coefficients are functions of electron temperature. The electron balance equation is considered as a nonlinear eigenvalue problem with boundary conditions of the third kind. The spectral parameter is the characteristic value of the electron temperature T_e^*, defined as a solution of the nonlinear equation $\lambda_0(T_e^*) = 1$. Here λ_0 is the smallest eigenvalue of the Sturm–Liouville problem for electrons. Based on T_e^* and the system of equations, the values of $E_R = E(R)$, $H_R = H(R)$, $n_{e0} = n_e(0)$, where R is the discharge radius, are found. The dependences of n_e, E, H, T_e^*, H_R on the frequency f, pressure p, and discharge radius R are investigated. The reported study was funded by Russian Science Foundation, according to the research project No. 19-71-10055.

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