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FULL-WAVE MODELING OF LOWER-HYBRID WAVES IN THE FT-2 TOKAMAK PLASMA WITH NON-MAXWELLIAN ELECTRON DISTRIBUTION FUNCTION THAT IS A SOLUTION OF THE FOKKER-PLANCK EQUATION *)

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One of the most popular and effective methods of non-inductive current drive in tokamak plasmas is based on the use of lower-hybrid (LH) waves. Damping of LH waves on electrons via Landau mechanism results in the quasilinear diffusion of electrons in the velocity space, and (provided that the high-frequency power is high enough) in the formation of the plateau on the electron velocity distribution function (EDF) and in the generation of LH current [1]. Evolution of the EDF (both in time and space) due to the quasilinear diffusion and interparticle collisions is usually obtained from the solution of the Fokker-Planck equation. Deviations of the EDF from the equilibrium Maxwellian distribution, in turn, lead to a change in the plasma dielectric tensor and, as a consequence, modify propagation and absorption conditions of LH waves. Therefore, when numerically modeling LH waves in a tokamak plasma, it is also important to study the impact of the non-Maxwellian EDF on the waves propagation and absorption.

In the present paper we describe the modification of the 2D full-wave code WaveTOP2D [2, 3] (based on the numerical solution of the wave equation in the 2D inhomogeneous tokamak plasma in the toroidal geometry) that was carried out in order to take into account the non-Maxwellian EDF in the longitudinal component of the dielectric tensor, which determines electron Landau damping. We present the results of full-wave simulations of propagation and absorption of LH wave in the FT-2 tokamak plasma with the EDF calculated independently by solving the Fokker-Planck equation in corresponding programming module of the ray-tracing code FRTC [4, 5] based on the WKB approximation. The comparison of the results of LH waves simulations in the FT-2 tokamak performed by the full-wave code WaveTOP2D and ray-tracing code FRTC – both for the Maxwellian and non-Maxwellian EDF – is also presented. Some conclusions are made concerning the situations when the account of the non-Maxwellian EDF is necessary for the correct computation of LH power absorption as it can have some impact on the current drive efficiency.

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