Numerical modeling of the lower-hybrid current drive using the dynamic FRTC and ASTRA codes [[1]](#footnote-1)\*)

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Numerical modeling of the generation of the current drive in a tokamak using waves of the lower hybrid (LH) range is of great interest and has been actively pursued over the past two decades [1-4]. The parameters by which the experimental and theoretical data can be compared are bypass voltage, synchrotron, SXR, and HXR cure. Modeling these parameters is quite challenging. Numerical codes make it possible to calculate the LH current that is generated in the plasma, the distribution of current density over a small radius, the distribution of the input power and its absorption, tracking the ray paths for the LH band waves, and the loop voltage of the plasma as a function of time.

In this work, we compare the experimental and calculated values of the loop voltage obtained as a result of the nonstationary simulation of the LH current. Plasma equilibrium was calculated using the ASTRA transport code [5], ray tracing was calculated using the FRTC code [4, 6], and the drag current was calculated using the distribution function obtained by solving the Fokker-Planck equation taking into account the electric field. To calculate the spectrum of the longitudinal refractive index of the LH wave, we used the Grill3D program [7].

Simulation using an implicit difference scheme showed that the calculated loop voltage falls more slowly than in the experiment, due to the insufficient accuracy of this numerical method. In this paper, for the first time, the results of modeling the LH current drive using the Cheng-Cooper scheme [8] for the implicit discretization of the second order in space and the first order in time are shown with the addition of special weight coefficients that do not allow the occurrence of negative values of the distribution function and with high accuracy preserve the conservativeness of the system, in contrast to the Crank-Nicholson [9] method and the usual second-order implicit difference scheme. The simulation was carried out for the parameters of discharges in the FT-2 and Globus-M2 tokamaks.

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