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SIMULATIONS OF FAST MAGNETOSONIC WAVES PROPAGATION IN DEUTERIUM AND HYDROGEN PLASMAS PERFORMED FOR CYLINDRICAL GEOMETRY USING PARAMETERS OF THE L-2M STELLARATOR *)

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It is planned at the L-2M stellarator to conduct experiment on current drive using the conversion of fast magnetosonic (FMS) waves into slow waves followed by their absorption by plasma electrons. For performing these experiments, it is important to know the parameters of the excited FMS waves, in particular, their wave numbers and attenuation lengths. For this purpose, the simulations of propagation of FMS waves at the ion cyclotron resonance frequency excited by the poloidal antenna in deuterium and hydrogen plasmas in the ohmic heating regime of the L-2M stellarator plasma were performed. The model of cold collisionless cylindrical plasma was used. In the ohmic heating regime, the plasma parameters in the L-2M stellarator are such that the use of such a model is justified (the electron temperature is T_e ~ 300 eV, ion temperature is T_i ~ 100 eV, average plasma density is $n_e \sim (1–3) \times 10^{19}$ m^{-3}). It was assumed that the external magnetic field is uniform over the plasma column cross-section and has only the longitudinal component B_z. It was assumed that the plasma density depends only on the radial coordinate, and the density profile corresponds to the experimental data for the ohmic heating regime.

As a result of the simulations, for the first three azimuthal wave numbers (m = 1, 2, 3), the longitudinal wave numbers of the FMS waves excited in deuterium plasma as functions of the plasma density were obtained (Fig. 1).

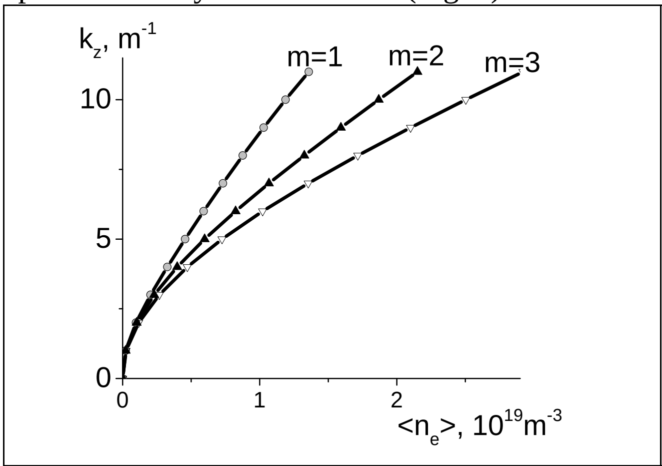

Fig. 1

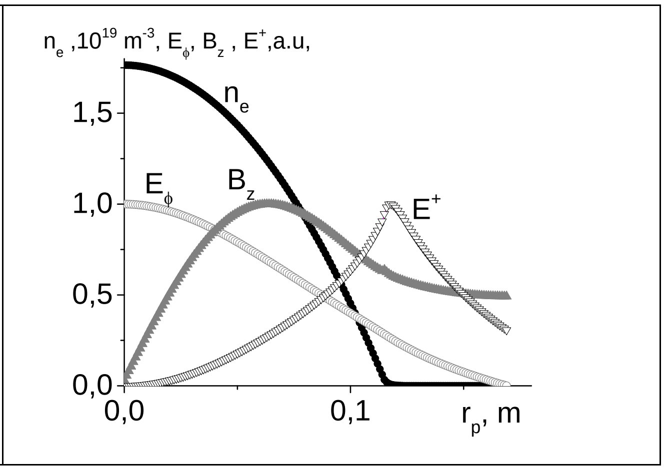

Fig. 2

Figure 2 shows the profiles of the electric and magnetic field components of the wave for deuterium plasma, as well as the profile of the E^+ component (the electric field component of the wave with circular polarization responsible for the ion cyclotron absorption of the FMS wave). $E^+ = E_r + iE_\varphi$, and for this component, the direction of rotation of the polarization vector coincides with the direction of cyclotron rotation of ions in the magnetic field..

Simulations of the FMS wave propagation in hydrogen plasma were also performed in the frequency range of $\omega = (20 – 40)\omega_{ci}$, i.e. in the helicon frequency range.

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