The ECH region displacement in the L-2M stellarator and the change in short wavelength turbulence parameters

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In the case of electron cyclotron heating (ECH) of plasma with high density values which are close to a microwave beam cut-off the refraction of the beam is enhanced. This leads to change in radial profiles of heat sources. As consequences of such heat sources redistribution one can expect a change in the electron temperature profile, in the electron density profile and in the ambipolar field, and a corresponding change in the transport processes and in the energy balance in a plasma column. In the report we present the results of observation of the ECH region displacement in L2-M stellarator plasmas as well as the change in short wavelength (*k*s ≈ 30 cm-1) turbulence parameters, which accompanies this displacement. For the ECH (X2 scenario — extraordinary wave, second electron cyclotron resonance harmonic) two 75 GHz gyrotrons were used with total input power about 600 kW. Heating region location measurements were performed using a detection of a reflected from this region ECH gyrotron wave and a determination of the wave phase [1]. Turbulence spectra and energy were obtained using backscattered radiation of the same ECH gyrotron [2]. Ray-tracing calculations with TRUBA code [3] showed that during the line-averaged density increase from 1.8·1013 cm-3 to 2.6·1013 cm-3 ECH region shifts outwards along the line *B*0 = *B*res. The measurements of the ECH region displacement were performed for two cases of line-averaged density evolution during the ECH. In the first case, during the first half of the ECH the density was maintained almost constant and during the second half the density increased from 1.4·1013 cm-3 to 1.8·1013 cm-3. It was found that the ECH region shifts of a 2-3 cm from the plasma core towards the edge. In the second case, there was continuous density increase during ECH. The shift value increased up to 4 cm. Features of the first case are the density fluctuations energy increase (during line-averaged density increase), the X-wave backscattering coefficient increase from 0.3·10-4 to 1.5·10-4 and the reflection (from ECH region) coefficient decrease from 3·10-4 to 0.6·10-4. The most part of the spectra energy is in the spectral range below 0.3 MHz. Features of the second case are the density fluctuations energy increase during the whole discharge, the backscattering coefficient increase from 1·10-4 to 9·10-4 and the reflection coefficient decrease from 3·10-4 to 0.7·10-4. It was found that the short wavelength density fluctuations spectra energy increases principally for frequencies above 0.3 MHz and that the broad band arises with a center at 0.7 MHz. For this experimental scenario the experiments on scattering of an ordinary (O-wave) wave which arises during splitting of linearly polarized gyrotron radiation [4] were also carried out. It should be noted that the refraction for an O-wave is lower that for an X-wave. The results of the O-wave experiments confirmed these from X-wave scattering.

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