EVOLUTION OF TURBULENT DENSITY FLUCTUATIONS AT NON-STATIONARY ECR HEATING WITH A MICROWAVE PULSE TRAIN AT THE L-2M STELLARATOR

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Experiments on non-stationary electron-cyclotron resonance (ECR) heating that are discussed in the present work were carried out using microwave pulse train at central 0.4 MW ECR heating of plasma. For the experiments various pulse lengths (1.0, 2.5 or 4.0 ms) and various delays (2.5 or 4.0 ms) between pulsed were used. Average electron density in the experiments was about 2.0-2.2·1019 m-3, and central electron temperature was about 0.5 keV. Turbulent density fluctuations with wavenumber *k* = 30 cm-1 were measured from backscattering of gyrotron (high-power microwave generator) radiation that actually heats plasma. Density fluctuations with wavenumber *k* = 20 cm-1 were measured from scattering of the gyrotron radiation at π/2 angle while long-wavelength fluctuations were measured from small-angle scattering of the same radiation [1-3].

From backscattering of the extraordinary (X-) component of the heating wave it was found that a burst (1-2 ms duration) of turbulent fluctuations arises at the start of each ECR heating pulse and after that only twofold decrease of the fluctuations level is observed for the remaining pulse duration. Similar evolution of fluctuations level was found from π/2 scattering and from small-angle scattering of X-wave. In the case of ordinary (O-) component scattering at π/2 angle it was found that after the first burst (1-2 ms duration) of the fluctuations level in each pulse an additional burst (1 ms duration) arises and after this burst decrease of the fluctuations level is observed till the pulse end. Elongation of the interpulse delay doesn’t change the overall picture of fluctuations evolution although it does lead to decrease of electron temperature at the start of each ECR heating pulse. From comparison of density fluctuations evolution with electron temperature evolution and with plasma stored energy one can found that fluctuations bursts coincide in time with periods of simultaneous increase of temperature and energy. In these periods strong density perturbations are possible due to increase of plasma pressure in the energy absorption region and formation of steep density gradient there which in turn should lead to increase of growth rates of drift instabilities.

It seems that temporal evolution of turbulent density fluctuations of various scales at non-stationary ECR heating is defined by density perturbations caused by heating process. This hypothesis is supported by the fact of different temporal evolution of X- and O-wave scattering.

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