COMPARATIVE ANALYSIS OF ELECTRON CYCLOTRON RADIATION POWER LOSSES IN TOKAMAKS IGNITOR AND ITER

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IGNITOR project [1]–, [2], [3], [4] aims to demonstrate the possibility of the ignition achieved by ohmic heating alone (or with minimum use of auxiliary heating). The achievement of the required value of the toroidal plasma current to reach thermonuclear temperatures by the ohmic heating, requires the use of a strong toroidal and poloidal magnetic field, more than 2-4 times greater than, respectively, the toroidal and poloidal magnetic field in conventional tokamaks. This requires a detailed analysis of the possible impact of the increase of the magnetic field on the assessment of the baseline scenarios for IGNITOR tokamak operation and the optimization of the main plasma parameters.

A comparative analysis of the role of power losses on the electron cyclotron (EC) radiation in tokamaks IGNITOR and ITER is carried out (including the calculation of the spatial and spectral characteristics of the EC radiation losses). The analysis is stimulated by the quest for developing the methods of predictive modeling of reference scenarios of the IGNITOR tokamak operation with allowance for the advanced experience of the so called integrated numerical modeling of such scenarios for the ITER tokamak (see, e.g., simulation [5] carried out with transport code ASTRA [6]). A detailed analysis of the role of the EC power losses in the local and total energy balance in the “steady state” regime of ITER operation was carried out in [7]. A comparison of the EC power losses in ITER and IGNITOR is carried out both for the equilibrium (Maxwellian) electron velocity distribution function (EVDF) and typical expected deviations of the EVDF from a Maxwellian. It is shown that despite a strong magnetic field as compared with large operating tokamaks and under-construction ITER tokamak, the EC power losses in IGNITOR do not influence strongly the local electron energy balance and do not make a serious problem for a steady-state fusion burning.

References.

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