First results of core and edge plasma instability simulations at Globus-M

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This work represents the first results of core and edge plasma instability simulations at Globus-M. Globus-M was a compact spherical tokamak with typical parameters are as follows: $\varepsilon = 0.24$ m / 0.36 m = 0.66, B_T= 0.4-0.5 T, I_p = 0.18-0.25 MA, $\langle n_e \rangle$ = (1-8) $\bullet 10^{19}$ m^{-3}, $P_{NBI} \leq 1$ MW. The H-mode is a common operational regime at moderate densities both in OH and NBI heated discharges. The first part of the report is devoted to simulations of the edge plasma peeling-ballooning mode instability using BOUT++ code [1]. Simulations were performed in linear approximation with restricted high-n toroidal modes (n < 16). Instability structure with the mode toroidal number n=12 was found to be the most unstable. This statement is in agreement with DBS measurements [2] and could be an evidence of ballooning branch destabilization. The second part is concentrated on core and edge plasma microinstability simulations using GKW code [3] in linear approximation. The edge plasma of Globus-M tokamak has typical toroidal beta higher than 3% and found to be kinetic-ballooning unstable. It motivates to investigate edge plasma stability using EPED-like model [4]. The core plasma in Globus-M is characterized by the moderate collisionality, high normalized Larmor radius and beta. These conditions are unusual for plasma of present day tokamaks. Linear gyrokinetic simulations were performed for identifying electromagnetic or electrostatic origin of dominating microturbulence that may explain existing Globus-M $B\tau_E$ scaling.

References

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