Influence of the collisionality and the safety factor on the transport in the Globus-M spherical tokamak

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The presentation is devoted to analysis of the thermal energy confinement in Globus-M [1]. Globus-M was a spherical tokamak with the major radius R=0.36 m, minor radius a=0.24 m, the ranges of operational current and toroidal magnetic field were I_p=100-250 kA and B_T=0.3-0.5 T correspondingly. The aim of the research was to identify the thermal insulation efficiency in a compact spherical device in terms of the electron and ion diffusion coefficients for different discharge conditions. The experimentally measured electron and ion temperature profiles as well as more accurate estimations of the NBI absorbed power allowed us to provide increased accuracy of the transport modelling using ASTRA code [2]. It was found that both B_T and I_P increase had a strong effect on the electron and ion heat diffusivities (χ_e and χ_i respectively). The comparison of χ_i with neoclassical theory was performed and the role of the collisionality (ν^*) and safety factor (q) on the transport was analyzed. The influence of the q=1 resonant surface presence on the plasma performance was studied. The NBI at the current ramp-up phase permitted distinguishing the relatively long phase with inversed q profile, while minimum value of q (q_{min}) in the plasma core was more than one (AT-like q profile). Such modes can be characterized by improved core confinement and are usually accompanied by formation of the internal transport barriers (ITB). The ITB formation is also relevant for the pure ohmic heated plasma.

References

[1] Gusev V. K. et al, 1999 Tech. Phys. 44 1054.

[2] Pereverzev G. and Yushmanov P. N., 2002, Max-Plank IPP Report 5/98.