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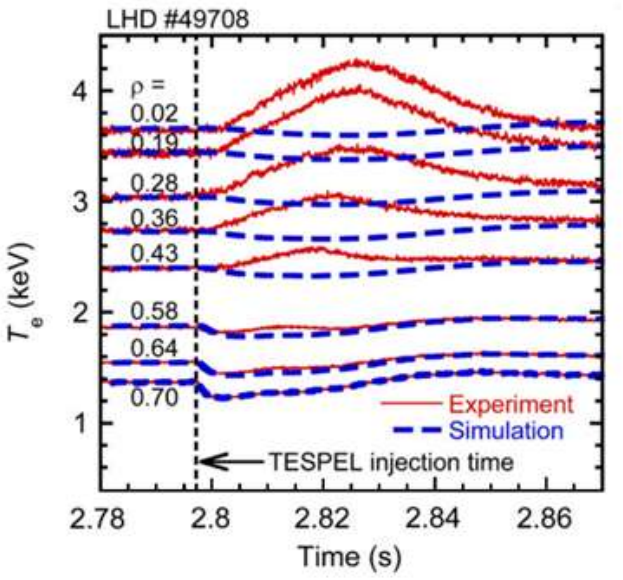
MODELING OF NON-LOCAL HEAT TRANSPORT PHENOMENON DURING POLYSTYRENE PELLET INJECTION INTO THE LHD PLASMA *)

[1]Krivosheev A.N., [1]Sergeev V.Yu., [2]Skokov V.G., [1]Lashkina Yu.S.

[1]*Peter the Great Saint-Petersburg Polytechnical university*
[2]*National Research Center "Kurchatov Institute"*

The phenomenon of "non-local transport" (heating/cooling of the plasma center during cooling/heating the periphery) still does not have a generally accepted explanation. An example of such a phenomenon after the injection of a polystyrene macroparticle into the plasma of the LHD heliotron [1] is shown in the figure with red curves. The blue broken lines in the figure show the calculated evolutions of the electron temperature with the electron heat diffusivity coefficient $\chi_e^{PB}(r)$ from the stationary energy balance equation in the case of a diffusion model of a stationary plasma. There are attempts to explain this phenomenon by the spatial-temporal evolution of the electronic heat diffusivity coefficient $\chi_e(r,t)$. Physical models explaining such evolution are just being created [1,2].



In [3], it shown that when creating a perturbation of plasma parameters, it is necessary to take into account the possibility of perturbation of equilibrium and plasma motion, which can lead to the exchange of thermal and magnetic energy during the propagation of the perturbation. Modeling plasma motion with velocity $v(r,t)$ during the pellet injection into the LHD [4] demonstrated the efficiency of this method.

This paper develops algorithms to study both of the above approaches using experimental data on the evolution of electron temperature $T_e(r,t)$ and density $n_e(r,t)$ in LHD. The algorithms make it possible to reconstruct the evolution of either $\chi_e(r,t)$ under the assumption $v(r,t) \equiv 0$, or $v(r,t)$ under the assumption $\chi_e(r,t) \equiv \chi_e^{PB}(r)$.

Developed techniques are used to analyze the propagation of disturbance in the LHD [2], in which it was experimentally demonstrated that the "non-local transport" phenomenon depends on the plasma density and/or on the created perturbation.

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