CONDITION OF DAMPING OF ANOMALOUS RADIAL TRANSPORT, DETERMINED BY ORDERED CONVECTIVE ELECTRON DYNAMICS

V.I.Maslov, S.V.Barchuk, V.I.Lapshin, E.D.Volkov
NSC Kharkov Institute of Physics and Technology, Kharkov 61108, Ukraine
e-mail: vmaslov@kipt.kharkov.ua

Anomalous plasma particle transport due to low-frequency perturbations in the cross-field edge region of the toroidal devices is investigated now intensively. In turbulence of small amplitudes the electron trajectories are stochastic. At achievement of the large amplitudes when frequency, Ω, of the electron oscullations in the convective cell of the perturbation exceeds the growth rate of its excitation, $\Omega(t)>\gamma$, the cell changes in its vicinity the electron density gradient ∇n_e, which strengthens the next cells. Thus on the cell bounderies the jumps of $n_e(\mathbf{r})$ arise. On these jumps the growth rates of the next cell excitation are much more than the growth rate, determined by not perturbed ∇n_e. It provides faster electron transport. In other words, the selfconsistent excitation of the low-frequency convective cells in the nonequilibrium plasma, drifting in crossed electric and magnetic fields in stelarator, by a radial gradient of density is unstable concerning occurrence of correlations. Thus convective-diffusion radial electron transport and partly ordered lattice of convective cells in space (r, z) arise. The perturbations of lattice-electron bunches reflect resonant electrons. The perturbations of lattice-electron holes trap resonant electrons. The convective-diffusion equation, describing these convective-diffusion radial dynamics of the electrons has been derived. It has been shown, that in the plasma, drifting in crossed electric and magnetic fields in stelarator, two kinds of perturbations, strongly distinguished on properties, are excited: not moving and quickly moving convective cells. The spatial structures of these not moving and quickly moving convective cells have been constructed. It has been shown, that the radial dimensions of these convective cells depend on their amplitudes and essentially depend on a radial gradient of density. It has been shown, that the observed fingers of density in peripheral area may be explained by the formation of these convective cells. The dispersion equation, describing the excitation of the perturbations in collisional plasma of stelarator, drifting in the crossed electric and magnetic fields, has been derived. It has been shown, that there is the universal parameter, controling the excitation of these perturbations. It has been obtained, that at the certain values of the system, determined by this parameter, the excitation of these perturbations is suppressed. Certainly, in this case the anormalous radial transport is suppressed.