EVOLUTION EQUATION OF INTERMITTENCY OF LOW FREQUENCY VORTICES NEAR WALL IN NUCLEAR FUSION DEVICES

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The crossed structure of electric and magnetic fields near the wall in nuclear fusion devices is very important. The crossed electric and magnetic fields near the wall in nuclear fusion devices can lead to excitation of low frequency perturbations by radial gradients of the plasma parameters. These perturbations can be a vortical turbulence. It is investigated theoretically in this paper in the cylindrical approximation the excitation of the vortical perturbations. It is shown that the process of vortices excitation is unstable with respect to arising of correlation between an electric field and radial electrons' movement, when the vortex-electron interaction time becomes smaller than the inverse growth rate of vortex amplitude. In this case a convective radial movement of electrons and chain along stellarator surface in the case of intermittency of vortices in space (r, z) are appeared. Vortices of the chain reflect and trap the resonant electrons. In this case the fingers of electron density near wall in stellarator are formed.

The spatial structure of the electron trajectories in the fields of these vortical perturbations are constructed. The expression for the frequency of the electron oscillations in the field of the vortex is derived. The convective-diffusion equation is derived. At instability development of vortical turbulence excitation the intermediate regime of radial particle transport (convective-diffusion) is realized.

At instability development of vortical turbulence excitation the vortices not only result to convective-diffusion radial dynamics of electrons, but also can move collisionlessly in the radial direction, similar to observation.

In this paper it is also shown that taking into account of longitudinal electron dynamics can lead to damp of turbulence excitation in the following case. Namely, the lattice of vortices is not formed if period of electron movement along stellarator surface is shorter than time of instability development.

The radial transport equation of intermittency has been derived.