Plasma Electron Over-Heating near Rational Surface with Magnetic Islandes, Leading to Shear Enhancement

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Now internal diffusion barrier (IDB) formation is widely investigated problem [1]. Role of magnetic islands in nuclear fusion plasma are investigated now intensively [2, 3]. In particular, their effect on IDB formation is very important. Also effect of electron dynamics near rational surface with the poloidal chain of narrow magnetic islands also is very important [4]. Distribution of radial electrical field near poloidal chain of magnetic islands is changed strongly at additional electron heating [3], that toroidal electron motion is more quick than radial. Thus the peak of pressure arising on rational surface, partly damps plasma electron penetration in an island, resulting that electrons pass islands at their radial movement. It results in shear strengthening and formation of intermediate IDB. Under intermediate IDB we mean strong shear formation in a vicinity of poloidal chain of narrow magnetic islands with electron pressure peak on rational surface. The balance of forces, ensuring shear strengthening is constructed.

We estimate the electric field shear and shear of azimuth electron velocity, which can be formed near islands. We consider in consent with [2, 3] the value of shear of azimuth electron velocity, formed due to plasma heating near the low order rational surface with poloidal chain of narrow magnetic islands. Because distance between electron trajectories grows with time on non-rational surfaces this can lead that plasma is overheated near rational surface. This overheating can provide IDB. Small part of electrons leaves the island and the essential shear is formed. This overheating can be small, of order of 1%, for IDB formation. Radial inhomogeneous distribution of excited oscillations can lead to ponderomotive force, which enhances shear. Narrow islands can lead to IDB. Several poloidal chain of islands are better for IDB as in experiment [2]. The case of two polloidal chains of narrow magnetic islands is considered.

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