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New Results for the Polarization Current Effect on NTM Threshold[1] KOKI IMADA, NATALIA TRONKO, HOWARD WILSON, University of York — For successful operation of future tokamaks, such as ITER, it is essential to control neoclassical tearing modes (NTMs): plasma instabilities characterized by the evolution of magnetic islands. Experimental observations show that sufficiently small magnetic islands heal themselves and shrink away. It has been suggested that the neoclassical polarization current, induced due to ion inertia, may contribute to the NTM threshold. However, the physics of polarization current is not fully understood in toroidal geometry. Slab model calculations show that the contribution from the narrow island separatrix layer opposes that away from the island, nearly cancelling each other out. However, no previous works have investigated this layer contribution in full toroidal geometry; this is essential for accurately determining the trapped particle effect and hence the overall sign of the polarization current. In this project, we aim to determine the full contribution of the polarization current in the tokamak toroidal geometry, including the separatrix layer contribution, using drift kinetic theory. If the polarization current contribution is found to be stabilizing, our new result will provide valuable information towards the development of effective NTM control system for ITER.

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