Abstract Submitted
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Plasma response and flow relaxation induced by resonant magnetic perturbation in the Rutherford regime[1] PING ZHU, Huazhong University of Science and Technology, University of Wisconsin-Madison, XINGTING YAN, University of Science and Technology of China, WENLONG HUANG, Anhui University of Technology — Externally applied non-axisymmetric magnetic fields such as error field and resonant magnetic perturbation (RMP) can influence the plasma momentum dynamics through plasma response in a tokamak, whereas the plasma response itself strongly depends on the plasma flow as well. Such a nonlinear interaction between the two has been modeled in an extended error field theory for a coupled system of toroidal and poloidal torque balance and magnetic island evolution equations in the Rutherford regime. For a more complete and self-consistent account, we solve for the nonlinear plasma response and the associated flow relaxation induced by a single-helicity RMP to a tokamak equilibrium with an initial uniform toroidal flow, using the full resistive MHD model in the NIMROD code. Simulations show that the time evolution of the parallel flow or "slip frequency" and its asymptotic relaxation to steady state are different from the island rotation frequency on resonant surface, which invalidates the "no-slip" condition often assumed for the Rutherford regime. The difference between theory and simulation also suggests nontrivial contributions from the non-resonant response.

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