Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

An analytic model of plasma response to external magnetic perturbation in absence of no-slip condition[1] WENLONG HUANG, Anhui University of Technology, PING ZHU, Huazhong University of Science and Technology, University of Wisconsin-Madison — Recent simulation and experimental results suggest that the magnetic island and flow on resonant surface often do not satisfy the "no-slip" condition even in the Rutherford regime. A new theory model on nonlinear plasma response to external magnetic perturbation in absence of "no-slip" condition is proposed. The model is composed of the evolution equations for both island size and phase due to forced reconnection driven by the external magnetic perturbation, and the force-balance equation for the plasma flow. When the island width is much less than the resistive layer width, the island growth is governed by the linear Hahm-Kulsrud-Taylor solution in presence of plasma flow. In the other regime when the island width is much larger than the resistive layer width, both island width and phase evolutions are described using the Rutherford theory. The corresponding quasi-linear electromagnetic force and viscous torque determine the force balance for plasma flow. The no-slip condition assumed in the conventional error field theory is not imposed here, where the island oscillating frequency depends on but does not necessarily equal to the plasma flow frequency at the rational surface.

[1]Supported by Fundamental Research Funds for the Central Universities at HUST Grant No. 2019kfyXJJS193, National Natural Science Foundation of China Grant No. 11775221, and U.S. Department of Energy Grant Nos. DE-FG02-86ER53218 and DE-SC0018001.

Ping Zhu
University of Science and Technology of China

Date submitted: 02 Jul 2019 Electronic form version 1.4