Abstract Submitted
for the APR12 Meeting of
The American Physical Society

Simulation of Non-resonant Internal kink mode with Toroidal Rotation in NSTX[1] FENG WANG, Dalian University of Technology, GUOYONG FU, JOSH BRESLAU, Princeton University — Plasmas in spherical tokamak with a safety factor above unity and weakly reversed magnetic shear may be unstable to an ideal, non-resonant internal kink mode. This mode, termed the "long-lived mode" (LLM) in MAST [1], will saturate and persist, exhibiting a strong m/n=2/1 component in NSTX. The resulting magnetic islands are capable of seeding neoclassical tearing modes (NTMs) [2]. Experimental results show that coupled 1/1 and 2/1 kink/tearing modes can also limit the sustained plasma beta. In this work, we perform nonlinear MHD simulations of the behavior of the non-resonant internal kink using M3D code initialized with measured NSTX equilibrium profiles. In particular, the effects of toroidal rotation are investigated systematically. The results show that when the rotation velocity is near the experimental level, its effect of equilibrium and linear stability is small. The nonlinear saturation level of the 1/1 mode is also weakly affected. However, the rotation is observed to have significant effects on the 2/1 island even at small value. With finite rotation, the 2/1 island width exhibits oscillations in the initial evolution before final steady state saturation. The width of the saturated island is reduced greatly as compared to that of non-rotating case. [1] I. Chapman et al Nuclear Fusion 50 (2010) 045007 [2] J. Breslau et al Nuclear Fusion 51 (2011) 063027

[1]This work is supported by the US Department of Energy under DE-AC02-76CH03073, and China Scholarship

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Date submitted: 11 Jan 2012 Electronic form version 1.4