## Abstract Submitted for the DPP14 Meeting of The American Physical Society

Characteristics of Neoclassical Toroidal Viscosity in NSTX and KSTAR for Rotation Control and the Evaluation of Plasma Response<sup>1</sup> S.A. SABBAGH, J.W. BERKERY, Y.S. PARK, Columbia U., R.E. BELL, D.A. GATES, S.P. GERHARDT, I. GOUMIRI, PPPL, T.E. EVANS, N. FERRARO, General Atomics, Y.M. JEON, W. KO, NFRI, K.C. SHAING, Nat'l Cheng Kung U., Y. SUN, ASIPP — Three-dimensional magnetic fields producing non-resonant magnetic braking allow control of the plasma rotation profile,  $\omega_{\varphi}$ , in tokamaks. Experimental angular momentum alteration created by 3D field configurations with dominant n = 2 and n = 3 components in NSTX is compared to theoretical neoclassical toroidal viscosity (NTV) torque density profiles,  $T_{NTV}$ . Large radial variations of  $T_{NTV}$  are typically found when flux surface displacements are computed using ideal MHD assumptions. In contrast, experimentally measured  $T_{NTV}$  does not show strong torque localization. This may be explained by ion banana width orbit-averaging effects. A favorable characteristic for  $\omega_{\varphi}$  control clearly illustrated by KSTAR experiments is the lack of hysteresis of  $\omega_{\varphi}$  when altered by non-resonant NTV. Results from a model-based rotation controller designed using NBI and NTV from the applied 3D field as actuators are shown. The dependence of  $T_{NTV}$  on  $\delta B^2$ significantly constrains the allowable field amplification in plasma response models when compared to experiment. Initial analysis shows that the single fluid model in the M3D-C<sup>1</sup> resistive MHD code produces a flux surface-averaged  $\delta B$  consistent with the experimentally measured  $T_{NTV}$ .

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