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Physics and Control of Toroidal Rotation Damping in NSTX[1]
W. ZHU, S.A. SABBAGH, A.G. SONTAG, J. BIALEK, Columbia University, R.E. BELL, J.E. MENARD, D.A. GATES, B.P. LEBLANC, PPPL, C.C. HEGNA, K.C. SHAING, D. BATTAGLIA, University of Wisconsin, NSTX RESEARCH TEAM —
Understanding plasma rotation damping mechanisms at high beta and low aspect ratio is important to sustain passive stabilization of MHD modes. Recent NSTX experiments use the new resistive wall mode (RWM) stabilization coils to control plasma toroidal rotation, and RWM rotation and growth. Plasma rotation damping/control was examined both below and above the ideal MHD no-wall beta limit. Non-resonant plasma rotation damping by n=1-3 applied fields was demonstrated. Rotation recovery was observed after the applied field was reduced. Quantitative comparison is made between neoclassical toroidal viscosity and other applicable theories and experiment to determine the physics and parameter dependence of the rotation evolution by the applied field and the observed instabilities. Applied n=1 fields propagating in the direction of plasma flow led to a longer period of RWM rotation. When the applied field propagated against the plasma flow, the RWM grew unabated and quenched the plasma.

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Wubiao Zhu
Columbia University

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