Abstract Submitted
for the APR09 Meeting of
The American Physical Society

Neoclassical Toroidal Viscosity Induced Rotation in Tokamaks and Quasi-symmetric Stellarators[1] A.J. COLE, C.C. HEGNA, J.D. CALLEN, University of Wisconsin — Non-axisymmetric magnetic perturbations generate variations in $|B|$ along a field line that induce non-ambipolar radial transport and a global toroidal force on the plasma, known as neoclassical toroidal viscosity [NTV]. A strong correlation exists between the flow evolution physics of tokamaks and quasi-helically symmetric [QHS] stellarators. In QHS-mode, there exists a helical symmetry angle $\alpha \equiv m\theta - n\zeta$, with m, n fixed integers that is analogous to the poloidal direction in tokamaks. As a result, there exists a direction of near helical symmetry and thus least flow damping along $\vec{e}_h$ such that $\vec{e}_h \cdot \vec{\nabla}\alpha = 0$, analogous to the toroidal tokamak direction. In this paper, a model analytic 'toroidal' rotation equation is developed which smoothly transitions between previously asymptotic low-collisionality regimes [1], while incorporating both electron and ion NTV. In particular, the transition from ion to electron dominated NTV is presented in a single equation for the first time. This research will facilitate future comparison between NTV-induced rotation in QHS stellarators and tokamaks. [1] K.C. Shaing, Phys. Plasmas, **10**, 1443 (2003).

[1]Research supported by U.S. DoE grants DE-FG02-86ER53218, DE-FG02-92ER54139, and DE-FG02-99ER54546.

Andrew Cole
University of Wisconsin

Date submitted: 09 Jan 2009 Electronic form version 1.4