Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Rotation roots and neoclassical viscosity in quasi-symmetry[1] A.J. COLE, C.C. HEGNA, J.D. CALLEN, University of Wisconsin — In a quasi-symmetric device, there exists a symmetry angle $\alpha_h = \theta - N\zeta/M$, such that $|B| = B_0\,(1 - \epsilon_h \cos M\alpha_h)$ along a field-line, with several much smaller helical 'side-bands.' Provided the departure from symmetry is small, i.e. $\delta B_{\text{eff}}/B_0 \ll \epsilon_h$ where $\delta B_{\text{eff}}/B_0$ is the effective helical sideband strength, flow damping and thus flow evolution along and 'cross' the direction of symmetry in a flux surface decouple [1,2], and can be determined successively. In the context of a fluid-moment approach [3], the momentum equation in the symmetry direction is equivalent to the ambipolarity condition. Steady state rotation solutions of this equation are equivalent to ambipolar radial electric field 'roots' in conventional stellarator theory and will be presented for various banana-drift neoclassical flow damping regimes [2].

[1] J. D. Callen, A. J. Cole, and C. C. Hegna, Tech. Rep. UW-CPTC 08-7, Univ. of Wisconsin, http://www.cptc.wisc.edu (2009).
[2] A. J. Cole, C. C. Hegna, and J. D. Callen, Tech. Rep. UW-CPTC 08-8, Univ. of Wisconsin, http://www.cptc.wisc.edu (2009).
[3] K. C. Shaing and J. D. Callen, Phys. Fluids 26, 3315 (1983).

[1]This research was supported by the U.S. Department of Energy under Grant Nos. DE-FG02-86ER53218, DE-FG02-92ER54139 and DE-FG02-99ER54546.

Andrew Cole
University of Wisconsin

Date submitted: 15 Jul 2009

Electronic form version 1.4