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Nonlinear gyrokinetic simulations of intrinsic rotation in up-down asymmetric tokamaks[1] JUSTIN BALL, MICHAEL BARNES, FELIX PARRA, Massachusetts Institute of Technology, WILLIAM DORLAND, University of Maryland, GREG HAMMETT, Princeton Plasma Physics Laboratory, STEVE COWLEY, Culham Centre for Fusion Energy — Experiments and theory show that tokamak plasmas with strong toroidal rotation and rotation shear can stabilize the resistive wall mode and exhibit a reduction in turbulent transport. However, using external neutral beams to inject toroidal momentum, as is done in many current experiments, would require a prohibitive amount of energy in larger, reactor-sized devices. The most promising alternative to achieve significant mean plasma flow in large devices is intrinsic rotation, the rotation that is observed in the absence of external momentum injection. Recent theoretical work concludes that up-down asymmetry in the poloidal cross-section of tokamaks can drive significant amounts of intrinsic rotation [1]. In this work, we extend GS2, a local delta f gyrokinetic code that self-consistently calculates momentum transport, to permit up-down asymmetric designs. We also present the results of nonlinear simulations of momentum transport in up-down asymmetric tokamak designs.

[1] Y. Camenen, et al. "Transport of Parallel Momentum Induced by Current-Symmetry Breaking in Toroidal Plasmas." Phys. Rev. Lett. 102, 125001 (2009).

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