Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Regimes of weak ITG/TEM modes for transport barriers without velocity shear[1] MICHAEL KOTSCHENREUTHER, University of Texas at Austin, X. LIU, University of Texas, D.R. HATCH, S.M. MAHAJAN, M.J. PUESCHEL, M. HALFMOON, University of Texas at Austin, I.J. MCKINNEY, University of Wisconsin at Madison, P. XANTHOPOULOS, Max Plank Institute for Plasma Physics , A. GARAFOLO, J. MCCLENAGHAN, General Atomics, S. DING, Institute for Plasma Physics, XI CHEN, General Atomics, M. ZARNSTORFF, Princeton Plasma Physics Laboratory — Electrostatic modes (ITG and TEM) usually dominate core transport, but we show there exists a regime where these modes are hugely weakened, enabling transport barriers without velocity shear. This regime has apparently arisen in multiple contexts: high beta poloidal ITB in DIII-D, ITB in JET with pellet injection, ITB observed in Wendelstein 7X, wide pedestal QH-mode pedestals and other pedestals. In all these cases the processes that greatly weaken ITG/TEM modes are similar. Through gyrokinetic simulations in model geometries and actual geometries, and a semi-analytic, Simplified Kinetic Model, we arrive at a clear understanding of these fusion friendly regimes made possible only by specific magnetic geometry characteristics plus substantial density gradients. Comprehensive electrostatic and electromagnetic gyrokinetic simulations with GENE show that for plasmas in this regime, linear modes are weak, and the nonlinear transport can be reduced by two orders of magnitude. Various experimental transport barriers on DIII-D will be used as examples, and stellarator geometries such as Wendelstein 7X, NCSX and HSX will also be considered.

[1]Work supported by US DOE grants DE-FG02-04ER54742, DE-AC02-09CH11466 and DE-FC02-04ER54698

Michael Kotschenreuther
University of Texas at Austin

Date submitted: 03 Jul 2019 Electronic form version 1.4