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Regimes of weak ITG/TEM for transport barriers without velocity shear[1] MICHAEL KOTSCHENREUTHER, X. LIU, D. R. HATCH, S. M. MAHAJAN, M. J. PUESCHEL, M. HALFMOON, University of Texas at Austin, M. ZARNSTORFF, Princeton Plasma Physics Laboratory, A. GAROFALO, J. MCCLENAGHAN, General Atomic, I. J. MCKINNEY, University of Wisconsin, J. QIAN, ASIPP, S. DING, General Atomic, C. GIROUD, J. C. HILLESHEIM, C. F. MAGGI, S. SAARELMA, Culham Centre fo Fusion Energy, X. CHEN, General Atomic, DIII-D TEAM TEAM, JET COLLABORATORS TEAM[2] — We show there exists a regime where coupled ITG/TEM modes are hugely weakened enabling Transport Barriers (TB). The passage to this regime has arisen in TBs in multiple experimental contexts: ITB in DIII-D, JET, W7X and EAST, H-mode pedestals on DIII-D and JET, and likely very many others. We examine representative cases of these. A distinguishing and crucial feature of the analysis is that the regime is understood in terms of general concepts of non-equilibrium thermodynamics. A constraint founded in momentum conservation limits fluctuations that try to maximize entropy production, and so enables steep gradients in TBs. A very large number of linear and non-linear gyrokinetic simulations with GENE are used, in controlled scans, and for experimental cases, with novel analytic tools to understand this regime and its underlying cause. The proposed National Compact Stellarator device gives especially favorable results.

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[2]See the author list of E. Joffrin et al. 2019 Nucl. Fusion 59 112021

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