Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Power Threshold Minimum for L-H Transition in Collisional and Collisionless regimes[1] MIKHAIL MALKOV, PATRICK DIAMOND, UCSD, KAZUHIRO MIKI, JAEA, Kashiwa, Japan, JOHN RICE, Plasma Science and Fusion Center, MIT, GEORGE TYNAN, UCSD — We study the physics of the power threshold $P_{th}(n)$ for L-H transition, by linking microscopics and macroscopics. The roles of the electron/ion heating ratio, electron-ion coupling in the threshold physics of the L→H transition and the $P_{th,min}(n)$ are the primary foci. Our 1D predator-prey model reveals the puzzling decrease in $P_{th}(n)$ as the combination of an increase in collisional electron-to-ion energy transfer and an increase in the heating fraction coupled to the ions. Both processes strengthen the edge diamagnetic electric field needed to lock in the mean electric field shear for the $L \to H$ transition. Overal, the power threshold minimum emerges as a crossover between the threshold decrease caused by a rise in heat fraction coupled to ions (directly or indirectly, from electrons) and the threshold increase (at higher n) supported by the rise in shear flow damping. Turbulence driven shear flows are needed to trigger the transition by extracting energy from the turbulence. The electron/ion heating mix is important to the transition, in that it, together with electron-ion coupling, regulates the edge diamagnetic electric field shear. Collisionless turbulent electron-ion heat transfer processes and the pulsed fuel/heat deposition will also be discussed.

[1]Supported by US DoE

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Date submitted: 21 Jul 2015 Electronic form version 1.4