Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Partial barriers to heat transport in monotonic-q and reversed shear 3-dimensional chaotic magnetic fields DIEGO DEL-CASTILLO-NEGRETE, Oak Ridge National Laboratory, DANIEL BLAZEVSKI, Institute for Mechanical Systems ETH Zurich, Switzerland — The quantitative understanding of the role of magnetic field stochasticity on transport in 3-D configurations is of paramount importance for the magnetic confinement of fusion plasmas. Problems of interest include the control of ELMs by RMPs and the assessment of heat fluxes at the divertor. In this contribution we present numerical solutions of the time dependent parallel heat transport equation describing transport of heat pulses in 3-D chaotic magnetic fields. To overcome the limitations of standard approaches, we use a Lagrangian-Green's function (LG) method that allows the efficient and accurate integration of the anisotropic heat transport equation with local and non-local parallel heat flux closures in integrable and chaotic B fields. The results provide conclusive evidence that even in the absence of flux surfaces, chaotic magnetic field configurations exhibit partial barriers to heat transport. In particular, high-order islands and remnants of destroyed flux surfaces (Cantori) act as partial "leaky" barriers that slow down or even stop the inward propagation of heat pulses. The magnetic field connection length, $<l_B>$, exhibits a strong gradient where the partial barriers form, and it reaches a plateau whose value determines the "porosity" of the barrier. Heat pulses are shown to slow down considerably in the shear reversal region and, as a result, the time delay of the temperature response in chaotic reversed shear configurations is about an order of magnitude larger than the time delay in monotonic q-profiles.

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Date submitted: 11 Jul 2014 Electronic form version 1.4