Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Asymptotic-preserving Lagrangian approach for modeling anisotropic transport in magnetized plasmas LUIS CHACON, DIEGO DEL-CASTILLO-NEGRETE, ORNL — Modeling electron transport in magnetized plasmas is extremely challenging due to the extreme anisotropy introduced by the presence of the magnetic field ($\chi_{\parallel}/\chi_{\perp} \sim 10^{10}$ in fusion plasmas). Recently, a novel Lagrangian method has been proposed[1] to solve the local and non-local *purely* parallel transport equation in general 3D magnetic fields. The approach avoids numerical pollution (in fact, it respects transport barriers –flux surfaces– exactly by construction), is inherently positivity-preserving, and is scalable algorithmically (i.e., work per degree-of-freedom is grid-independent). In this poster, we discuss the extension of the Lagrangian approach to include perpendicular transport and sources. We present an asymptotic-preserving numerical formulation that ensures a consistent numerical discretization temporally and spatially for *arbitrary* $\chi_{\parallel}/\chi_{\perp}$ ratios. This is of importance because parallel and perpendicular transport terms in the transport equation may become comparable in regions of the plasma (e.g., at incipient islands), while remaining disparate elsewhere. We will demonstrate the potential of the approach with various challenging configurations, including the case of transport across a magnetic island in cylindrical geometry.

[1]D. del-Castillo-Negrete, L. Chacón, *PRL*, **106**, 195004 (2011); DPP11 invited talk by del-Castillo-Negrete

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Date submitted: 12 Jul 2011 Electronic form version 1.4