Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

Fractional diffusion models of transport in magnetically confined plasmas DIEGO DEL-CASTILLO-NEGRETE, Oak Ridge National Laboratory — A class of models based on the use of fractional derivative operators is proposed to describe transport in magnetically confined plasmas. Fractional operators incorporate in a unified framework non-Fickian transport, non-Markovian ("memory") effects, and non-diffusive scaling. Recently, this formalism was applied to study transport in pressure-gradient-driven plasma turbulence [1]. Here we incorporate finite-size domain effects, boundary conditions, sources, spatially dependent diffusivities, and general asymmetric fractional operators. The model is applied to describe, at a phenomenological level, non-diffusive, non-local transport processes observed in fusion plasmas, including anomalous confinement time scaling, "up-hill" transport, pinch effects, and on-axis peaking with off-axis fuelling. [1] D. del-Castillo-Negrete, et al., Phys. Plasmas 11, 3854 (2004); Phys. Rev. Lett. 94,065003 (2005).

Diego del-Castillo-Negrete
Oak Ridge National Laboratory

Date submitted: 22 Jul 2005 Electronic form version 1.4