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Knudsen Reactivity Reduction: Kinetic Theory of Diffusion Process[1] ERIC NELSON, EVAN DODD, KIM MOLVIG, BRIAN ALBRIGHT, NELSON HOFFMAN, LANL, GEORGE ZIMMERMAN, ED WILLIAMS, LLNL — Previous work that found significant fusion reactivity reduction due to Knudsen layer losses [1], utilized a twice simplified treatment of the loss process that first went to the diffusion limit of the transport and then replaced the spatial kinetic diffusion operator by a local loss process. The derivation of kinetic diffusion utilized a stochastic differential equation technique to show that convection in combination with pitch-angle scattering yields spatial diffusion asymptotically over long time and spatial intervals. The same technique can be extended to include the independent energy scattering stochastic process. For the linear Fokker-Planck equation that governs the tail ions this gives a very efficient (particle like) numerical technique that can solve the complete ion tail problem in the three phase space dimensions of pitch-angle, energy, and spatial coordinate. The method allows inclusion of a temperature gradient and specified ambipolar electric fields. We present simulation results of the depleted tail distributions and fusion reactivities, and compare with the predictions of the simple local loss method.

[1] Kim Molvig, Nelson N. Hoffman, Brian J. Albright, Eric M. Nelson, and, Robert J. Webster (*submitted to Physical Review Letters,* 2012)

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