Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

DSMC simulations of vapor transport toward development of the lithium vapor box divertor concept[1] CHRISTOPHER JAGOE, Princeton Univ, JACOB SCHWARTZ, ROBERT GOLDSTON, Princeton Univ, Princeton Plasma Physics Lab — The lithium vapor divertor box concept attempts to achieve volumetric dissipation of the high heat efflux from a fusion power system. The vapor extracts the heat of the incoming plasma by ionization and radiation, while remaining localized in the vapor box due to differential pumping based on rapid condensation. Preliminary calculations with lithium vapor at densities appropriate for an NSTX-Uscale machine give Knudsen numbers between 0.01 and 1, outside both the range of continuum fluid dynamics and of collisionless Monte Carlo. The direct-simulation Monte Carlo (DSMC) method, however, can simulate rarefied gas flows in this regime. Using the solver contained in the OpenFOAM package, pressure-driven flows of water vapor will be analyzed. The use of water vapor in the relevant range of Knudsen number allows for a flexible similarity experiment to verify the reliability of the code before moving to tests with lithium. The simulation geometry consists of chains of boxes on a temperature gradient, connected by slots with widths that are a representative fraction of the dimensions of the box. We expect choked flow, sonic shocks, and order-of-magnitude pressure and density drops from box to box, but this expectation will be tested in the simulation and then experiment.

[1]This work is supported by the Princeton Environmental Institute.

Christopher Jagoe
Princeton Univ

Date submitted: 13 Jul 2016 Electronic form version 1.4