Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Results from a lithium vapor box test stand at PPPL and B2.5-Eunomia simulations for a proposed Magnum-PSI lithium vapor box experiment[1] J. A. SCHWARTZ, Princeton University, R. J. GOLDSTON, Princeton Plasma Physics Laboratory — The lithium vapor box is a concept for a divertor designed to handle the extreme heat fluxes generated in future fusion reactors. Within a slot lined with capillary-porous materials, Li vapor induces plasma detachment by cooling the divertor plasma until it volumetrically recombines. Strong differential pumping via condensation localizes the Li vapor. Two linear-geometry experiments study elements of the physics involved. A test stand at PPPL studies the evaporation, flow, and condensation of Li vapor in three 5 cm long, 5 cm diameter cylindrical boxes without plasma, as would occur between shots in near-term experiments. By using a Direct Simulation Monte Carlo code we were able to reproduce the measured value of mass transferred during the experiments to within $\pm 15\%$, and demonstrate the expected differential pumping. A second, proposed for the linear plasma divertor simulator Magnum-PSI, studies the interaction of a 4e20 m^{-3}, 1.5 eV, 1 cm radius plasma beam with a 16 cm long Li vapor cloud. In simulations with B2.5-Eunomia, a 12 Pa vapor cloud from a 625 °C liquid Li surface reduces the plasma pressure at the target by a factor of 15 and the heat flux there from 3.7 $\mathrm{MW\,m}^{-2}$ to 0.13 $\mathrm{MW\,m}^{-2}$; the power is dissipated within the vapor box.

[1]This work supported by US DOE Contract No. DE-AC02-09CHII466.

Jacob Schwartz
Princeton University

Date submitted: 29 Jun 2020 Electronic form version 1.4