Abstract Submitted
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The Lithium Vapor Box Divertor[1] ROBERT GOLDSTON, AMMAR HAKIM, GREGORY HAMMETT, MICHAEL JAWORSKI, Princeton Plasma Physics Laboratory, RACHEL MYERS, University of Wisconsin, Dept of Physics, JACOB SCHWARTZ, Princeton Plasma Physics Laboratory — Projections of scrape-off layer width to a demonstration power plant[2] suggest an immense parallel heat flux, of order 12 GW/m^2, which will necessitate nearly fully detached operation. Building on earlier work by Nagayama et al.[3] and by Ono et al.,[4] we propose to use a series of differentially pumped boxes filled with lithium vapor to isolate the buffering vapor from the main plasma chamber, allowing stable detachment. This powerful differential pumping is only available for condensable vapors, not conventional gases. We demonstrate the properties of such a system through conservation laws for vapor mass and enthalpy, and then include plasma entrainment and ultimately an estimate of radiated power. We find that full detachment should be achievable with little leakage of lithium to the main plasma chamber. We also present progress towards solving the Navier-Stokes equation numerically for the chain of vapor boxes, including self-consistent wall boundary conditions and fully-developed shocks, as well as concepts for an initial experimental demonstration-of-concept.

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[4]M. Ono, M.A. Jaworski, R. Kaita et al., Nuc. Fusion 53 (2013) 113030

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