Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Classical Impurity Transport: New Effects in High-Beta, Anisotropic, and Rotating 1D Systems IAN OCHS, ELIJAH KOLMES, NATHANIEL FISCH, Princeton University — The classical impurity pinch arises from the Braginskii and diamagnetic frictional forces between high-Z impurities and low-Z ions, and leads to the well-known result that peaked temperature profiles can flush impurities that will otherwise accumulate in the plasma core [S. Hirshman and D. Sigmar, Nuclear Fusion 21, 1079 (1981)]. However, in high-beta systems, or systems with field line curvature, grad-B and curvature drifts will also influence the impurity transport. We analyze the impurity pinch with these drifts added, in the simple context of a screw pinch with constant rotational transform. We find that high plasma beta tends to help flush impurities, while a large rotational transform tends to cause impurities to accumulate in the plasma core. Extensions to anisotropic temperature distributions and the rotating screw pinch are discussed. The results are relevant for tokamaks at large aspect ratio, magnetized liner fusion, and the newly-proposed wave-driven rotating torus (WDRT) fusion concept [J. Rax, R. Gueroult, and N. Fisch, Physics of Plasmas 24, 032504 (2017)]. This work is supported by DOE Grants DE-SC0016072 and DE-FG02-97ER25308.

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Date submitted: 16 Jul 2017 Electronic form version 1.4