Abstract Submitted
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Generating counter-rotating two-vortex flows in the Madison Plasma Dynamo Experiment via boundary-driven JxB stirring[1] D. WEISBERG, C. COOPER, I. KHALZOV, Y. LEE, J. MILHONE, J. WALLACE, C.B. FOREST, UW Madison, MPDX TEAM — The Madison Plasma Dynamo Experiment (MPDX) is a plasma device designed to explore magnetic field self-excitation across a range of astrophysical dynamo regimes. Numerical simulations have shown that a laminar counter-rotating two-vortex flow in spherical geometry will produce a large-scale dynamo at certain values of fluid Reynolds number (Re=LV/ν<300) and magnetic Reynolds number (Rm= $\mu_0\sigma$LV > 250). These requirements are achieved in large (L=1.5m), hot ($T_e > 10$eV), fast-flowing (Ma=$V/V_A \gg 1$) MPDX plasmas. This poster presents advances toward producing two-vortex flow using eight thermally emissive LaB_6 cathodes differentially biased up to 500V with respect to cold Mo anodes and drawing currents of up to 50A, generating a JxB torque and driving flow at the cusp-field magnetized edge of Ar, He, and H plasmas. We present Mach probe measurements showing momentum transport into the unmagnetized center of the plasma via ion-ion viscous coupling, as well as results of flow drive optimization in which a series of cathode biasing schema are tested with the goal of reproducibly generating specific global flow geometries. By changing the location and bias of each cathode/anode pair, we aim to control the pitch angle of the two-vortex flow with the intention of using pitch angle as an optimization parameter for dynamo generation. Flow measurements are compared to simulation results, and the sensitivity of internal flow structure to variations in cathode biasing schema is discussed.

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David Weisberg
UW Madison

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