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Investigating Confinement for Dynamo Action in the Madison Plasma Dynamo Experiment[1] CHRISTOPHER COOPER, IVAN KHALZOV, CARY FOREST, Department of Physics, University of Wisconsin, Madison, MPDX TEAM — First measurements of plasma temperature, density, and flow have been made on the Madison Plasma Dynamo Experiment (MPDX) that allow the particle and energy confinement as well as the plasma resistivity (η) and viscosity (ν) to be estimated. The MPDX is designed to create hot flowing plasmas with high magnetic Reynolds number $Rm = \mathrm{v_p L}/\eta >> 1000$, and adjustable fluid Reynolds number $10 < Re = \mathrm{v_p L}/\nu < 1000$, where the kinetic energy of the flow exceeds the magnetic energy ($\mathrm{M_A} = \mathrm{v_p}/\mathrm{v_A} >> 1$). Simulations show these parameter ranges generate large scale "slow" dynamos and small scale "fast" dynamos to be studied. The 3 m diameter vacuum vessel is lined with rings of alternately oriented >3 kG SmCo magnets to create a multicusp magnetic confinement scheme. Lanthanum hexaboride (LaB_6) stirring rods and molybdenum anodes inserted into the vessel are biased <500 V at 50 A each, heating and stirring the plasma. A model for particle and energy balance in MPDX is developed to predict T_e, T_i, and n_e (therefore Re, Rm, and M_A) over a scaling of input power and neutral density. This model is compared to data from the initial MPDX plasmas and a PIC code simulating cusp losses to predict the laboratory settings for dynamo onset. Plasma losses through a multicusp field are measured with probes and compared to theory.

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