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A Plasma Dynamo Experiment based upon Ring Cusp Confinement and Electrostatic Stirring CARY FOREST, UW Madison, GENNADY FIKSEL, NOAH HERSHKOWITZ, ROCH KENDRICK, STEVE COWLEY, UCLA, ERIK SPENCE, ETH Zurich — A new plasma experiment to investigate the self-generation of magnetic fields is proposed. The experiment consists of a spherical vacuum chamber with a series of permanent magnetics, with electrically insulated pole faces, in a ring cusp geometry (poles facing inward with alternating polarity along the vessel wall). The resulting field is axisymmetric and decays quickly away from the walls providing a large, magnetic field free region in the central region of the device. To stir the plasma, cathodes positioned between the magnet rings are biased such that the resulting electric field induces plasma rotation through the ExB drift. The flow drive principle is quite general and by controlling the poloidal profile of the toroidal rotation, high magnetic Reynolds number plasmas flows can in principle be generated that result in magnetic field self-generation or plasma flows unstable to the magnetorotational instability. Use of a plasma for such an experiment may allow the magnetic Reynolds number (the dimensionless parameter governing self-excitation of magnetic fields) to be approximately a factor of 10 larger than in liquid metal experiments and will be the first experiment to investigate self-excited dynamos in a plasma,the state of matter that makes up most naturally occuring astrophysical dynamos.

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