Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Strategies for Observing Self-excitation in the Madison Dynamo Experiment N.Z. TAYLOR, C.B. FOREST, E.J. KAPLAN, R.D. KENDRICK, A.M. RASMUS, University of Wisconsin-Madison — In the Madison Dynamo Experiment two counter-rotating impellers drive a turbulent flow of liquid sodium in a one meter-diameter sphere. One of the goals of the experiment is to observe the spontaneous generation of magnetic field. Initial runs of the Madison Dynamo Experiment saw intermittent bursts of a transverse dipole field similar to the induced field predicted by laminar kinematics, but no sustained self-excited field was observed. Recent numerical simulations have shown that turbulent fluctuations strongly increase the critical magnetic Reynolds number required for self-excitation, beyond the design parameters of the experiment. Three different techniques for accessing dynamos are currently being implemented on the experiment. First, the addition of an equatorial and poloidal baffles to the experiment will help in the reduction of large-scale turbulence and optimization of the helicity of the mean flow. Second, freely rotating segments of a symmetric airfoil will be added to the internal probe tubes to reduce vibration that prevented operation at full speed. Third, the externally applied field will be strengthened to explore a sub-critical dynamo transition that has recently been discovered using numerical simulations.

Nicholas Taylor
University of Wisconsin-Madison

Date submitted: 17 Jul 2009 Electronic form version 1.4