Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Perturbative Transport studies of Turbulent EMFs in the Madison Dynamo Experiment E.J. KAPLAN, C.B. FOREST, R.D. KENDRICK, A.M. RASMUS, N.Z. TAYLOR, UW Madison — Previous experiments on the MDE have demonstrated the need for a turbulent electromotive force to describe the dynamics of the magnetic field evolution. In these experiments a weak, DC external seed field—sharing the symmetry axis of the mean flow—was applied to a flowing sodium. Data modeling showed that the currents measured in the sodium could not be explained from the mean flow alone. However, the overall trend was not inconsistent with an enhanced resistivity (a beta effect). Two new experiments are underway to better characterize this turbulent EMF. First, time varying magnetic fields will be applied to perturbatively measure current transport. Second, an internal velocity probe is being developed to directly measure the correlation between magnetic and velocity fluctuations at a given location. This poster will present numerical models which study the degree to which a spatial variation in the resistivity can be determined from measured responses in a range of frequencies. A high current H-bridge amplifier has been constructed to apply 500 gauss, sinusoidal fields with frequencies up to 10 hz. The profile of the response will be measured by an internal array of 3D hall probes. This profile should provide a measure of the turbulent enhancement to resistivity, and the degree to which it is reduced by the presence of a mean magnetic field.

E.J. Kaplan
University of Wisconsin–Madison

Date submitted: 15 Jul 2009 Electronic form version 1.4