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Reduction of Turbulent Diamagnetism in the Madison Dynamo Experiment[1] E.J. KAPLAN, R.D. KENDRICK, M.D. NORNBERG, K. RAHBARNIA, A. RASMUS, U.Wisconsin–Madison, E.J. SPENCE, PPPL, N.Z. TAYLOR, C.B. FOREST, U. Wisconsin–Madison — The dynamo effect is a magnetic instability whereby a flowing conductor generates a magnetic field such as those seen in the Earth and Sun. The Madison Dynamo Experiment (MDE) is a 1 m diameter sphere filled with liquid sodium that aims to produce this effect in a flow driven by two counter rotating impellers. Previous experiments on the MDE demonstrated an induced axisymmetric magnetic dipole counter to the applied axisymmetric dipole. An antidynamo theorem exists that shows the observed diamagnetism is impossible in a two vortex flow, and is thus associated with a turbulent $\mathcal{EMF}$. This poster shows results from a new campaign with an equatorial baffle installed that drasically diminishes the turbulent diamagnetism. Spherical harmonic decomposition of the induced field also shows a reduction of higher order magnetic modes associated with three mode coupling between the applied field and large scale velocity fluctuations. Numerical simulations of the sodium flow with and without baffles also indicate the possibility of reduced hydrodynamic turbulence while maintaining a two vortex flow.

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