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Velocity Inversion from Magnetic Field Measurements in a Liquid Sodium Experiment[1] N.Z. TAYLOR, M.M. CLARK, C.B. FOREST, M.D. NORNBERG, J.P. WALLACE, University of Wisconsin - Madison — In an analogy to helioseismology, the measured induced magnetic field generated by a spherical flow of liquid metal is used to determine the mean velocity profile through an inversion process. In the Madison dynamo experiment (MDE) the two vortex flow, driven by two counter-rotating impellers, is predicted to self-excite at low magnetic Reynolds number in the laminar case. The conductive flow is probed with external magnetic fields and the resulting induced field is measured by external and internal hall sensors. The measurements are compared with a forward model prediction of the induced magnetic field which is adjusted to fit the data. Knowledge of the mean flow can be used to optimize the pitch of the flow using rotatable vanes. A direct measurement of the turbulent EMF confirms that turbulent eddies act as an enhanced resistivity, keeping the experiment below the dynamo threshold. The detrimental large-scale turbulence has been mitigated with the installation of baffles. Although no self-excited dynamo has been observed, the resulting induced field closely matches laminar predictions for flows just below threshold.

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