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MHD Turbulence in the Madison Dynamo Experiment MARK NORNBERG, University of Wisconsin-Madison, CARY FOREST, ROCH KENDRICK, ERIK SPENCE, ADAM BAYLISS, CRAIG JACOBSON, CARLOS PARADA — Initial results from the Madison Dynamo Experiment provide details of the inductive response of a turbulent flow of liquid sodium to an applied magnetic field. The magnetic field structure is reconstructed from both internal and external measurements. A mean toroidal magnetic field is induced by the flow when an axial field is applied, thereby demonstrating the Omega Effect. Poloidal magnetic flux is expelled from the fluid by the poloidal flow. Small-scale magnetic field structures are generated by turbulence in the flow. The resulting magnetic power spectrum exhibits a power-law scaling consistent with the equipartition of the magnetic field with a turbulent velocity field. The magnetic power spectrum has an apparent knee at the resistive dissipation scale. Large-scale eddies in the flow cause significant changes to the instantaneous flow profile resulting in intermittent bursts of non-axisymmetric magnetic fields, demonstrating that the transition to a dynamo is not smooth for a turbulent flow.

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