

Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Hydromagnetic Dynamics and Magnetic Field Enhancement in a Turbulent Spherical Couette Experiment DOUGLAS STONE, MATTHEW ADAMS, ONUR KARA, DANIEL LATHROP, University of Maryland, College Park — The University of Maryland Three Meter Geodynamo, a spherical Couette experiment filled with liquid sodium and geometrically similar to the earth's core, is used to study hydrodynamic and hydromagnetic phenomena in rapidly rotating turbulence. An external coil applies a magnetic field in order to study hydromagnetic effects relevant to the earth's outer core such as dynamo action, while an array of 31 external Hall sensors measures the Gauss coefficients of the resulting magnetic field. The flow state is strongly dependent on Rossby number, $Ro = (\Omega_I - \Omega_O)/\Omega_O$, where Ω_I and Ω_O are the inner and outer sphere rotation frequencies. The flow state is inferred from the torque required to drive the inner sphere. The generation of internal toroidal magnetic field through the Ω -effect is measured by a Hall probe inserted into the sodium. A self-sustaining dynamo has not yet been observed at rotation speeds up to $\Omega_O=3$ Hz, which is three-fourths of the design maximum of the experiment. However, continuous dipole amplification up to 12% of a small applied field has been observed at $Ro=+17.7$ while bursts of dipole field have been observed up to 15% of a large external applied field at $Ro=+6.0$ and up to 20% of a small applied field at $Ro=+2.15$.

Douglas Stone
University of Maryland, College Park

Date submitted: 01 Aug 2015

Electronic form version 1.4