Abstract Submitted
for the APR05 Meeting of
The American Physical Society

The Liquid Sodium Dynamo Experiment, NMTech and LANL[1]
STIRLING COLGATE, HUI LI, LANL, DAVE WESTPFAHL, HOWARD BECKLEY, ROCKY GIANANNI, TRAVIS MCKINNLEY, TIMOTHY MICKEY, NMIMT — Stirling Colgate, Hui Li, LANL, D Westpfahl, H Beckley, R Giananni, T McKinnley, T Mickey NMIMT. The liquid sodium $\alpha\omega$ dynamo experiment is designed to demonstrate how magnetic fields are generated in AGN and stars. Naturally occurring large scale astrophysical flows, Keplerian and star-disk driven plumes or convection create large scale $\alpha\omega$ dynamos where turbulence is less important. The experiment consists of two coaxial cylinders, $r_1 = 15$ cm, $r_2 = 30$ cm, $\Omega_1/\Omega_2 = 4$ at limiting stable Couette flow, with conducting liquid sodium between them. We calculate and expect that the shear of the rotational flow in the conducting fluid will convert a radial, quadrupole bias field into a stronger, x20 toroidal field, Rm = 120. This will demonstrate the ω gain of the dynamo. The MRI will be tested for dynamo gain. The α gain will require a modification to inject helicity by axial plumes as in convection in a rotating frame. These plumes periodically displace and rotate a fraction of the toroidal field back into poloidal field and thus achieve gain. The apparatus has been built and tested with hot oil in the laboratory and has demonstrated stable Couette flow.

[1]Supported by NMIMT and the DOE

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Date submitted: 13 Jan 2005 Electronic form version 1.4