Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

High Omega Gain in High Shear Dynamo Flow with Low Turbulence[1] STIRLING COLGATE, Los Alamos Nat. Lab. — The omega-phase of the liquid sodium alpha-omega dynamo experiment at NMIMT in cooperation with LANL has demonstrated a high toroidal field B_ϕ that is 8 times B_r where B_r is the radial component of an applied poloidal magnetic field. This enhanced toroidal field is produced by the rotational shear in stable Couette flow within liquid sodium at high Re $\sim$ 1.4 x 10^7 and magnetic Reynolds number Rm $\sim$ 120. A small turbulence in stable Taylor-Couette flow is caused by Ekman flow at the end walls, which causes an estimated turbulence energy fraction of (delta v/v)^2 $\sim 10^{-3}$. This result compared to three highly turbulent flow measurements with an omega gain of $\sim$1.4 is interpreted as "turbulence results primarily in the diffusion and dissipation of magnetic flux as compared to the possible creation of magnetic flux by dynamo action". Large scale low turbulence, coherent flows as opposed to turbulent flows alone are then required to create the magnetic fields of the universe.

[1]Support by LANL-DOE, NSF, and New Mexico Tech gratefully acknowledged.

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Date submitted: 06 Jul 2011 Electronic form version 1.4