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The New Mexico dynamo: the past, the present, and the future[1]

JIAHE SI, New Mexico Tech, STIRLING COLGATE[2], Los Alamos National Lab, ART COLGATE, RICHARD SONNENFELD, DAVID WESTPFAHL, JOE MARTINIC, New Mexico Tech, MARK NORNBERG, University of Wisconsin-Madison, HUI LI, Los Alamos National Lab — The New Mexico dynamo experiment was designed to simulate a star-disk collision. It consists of two co-axial cylinders to make Taylor-Couette (TC) flows simulating differential rotation of accretion disks. In response to a radial seed field of 10 Gauss, the ω-effect wound up the field lines to produce an 80-Gauss toroidal field. This is, to date, the largest gain obtained by any experiment in the world. We attribute this success to the largely coherent TC flow field in the instrument. Turbulence dissipates magnetic energy by increasing the effective resistivity of the fluid (the "β-effect") and has been observed by the Madison group. We will study this effect in our geometry by applying an external B-field pulse and observing its penetration into the liquid sodium flows vs time for varying levels of turbulence. In addition, we will revisit the ω-effect at varying levels of turbulence. The final challenge for the New Mexico dynamo is the pursuit of the α-effect. A plume injection apparatus has been devised and instrumentation for the full simulation of a star-disk collision is being developed.

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