Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Dynamo action with flow shear and magnetic shear N. LEPROVOST, E. KIM, University of Sheffield — Dynamo action is a fundamental mechanism that explains ubiquitous magnetic fields in a variety of systems, including astrophysical, geophysical and laboratory plasmas. In this contribution, we provide an analytical theory of dynamo (α and β effects) in 3D forced helical MHD turbulence [1]. By non-perturbatively incorporating the effect of shear, we show that the α and β effects are enhanced by a weak shear while strongly suppressed by strong shear. In particular, for strong shear, the β effect is shown to be much more strongly suppressed than the α effect with the scalings $\alpha \propto A^{-5/3}$ and $\beta \propto A^{-7/3}$, respectively (A is the strength of the shear). The quenching of the α and β effect by shear has recently been confirmed in a numerical experiment [2]. One of the interesting implications of these results is that the dynamo efficiency, conventionally measured by the dynamo number D, depends more strongly on the shear than conventionally assumed. Specifically, D scales as A^4 rather than A. Incorporating a shear in the magnetic field, we then discuss its effect on the stability. Magnetic shear is shown to destabilize when it is stronger than flow shear. On the other hand, a weak magnetic shear compared to flow shear weakens the stabilizing effect of flow shear, thereby leading to a stronger turbulence than in the case without magnetic shear.

[1] N. Leprovost and E. Kim, Astrophys J Lett. v696, L125 (2009); Phys. Rev. Lett., v100, 144502 (2008)
[2] D. Mitra et al, Astron & Astrophys, v495, 1 (2009)

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Date submitted: 13 Jul 2009 Electronic form version 1.4