Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Scaling laws in helical rotating turbulence: do they change with Reynolds number? A. POUQUET, NCAR, J. BAERENZUNG, INPG, P. MININNI, UBA, D. ROSENBERG, NCAR — In rotating turbulence, the presence of helicity leads to significant differences when compared to flows without global velocity-vorticity correlations, as seen using direct numerical simulations (DNS) with up to 1536^3 points, down to Rossby numbers $Ro \approx 0.06$. Long-lived laminar structures and turbulent vortices co-exist. The energy undergoes both an inverse and a direct cascade, the latter being self-similar with spectrum $E(k) \sim k^{-e}$ and transfer rate ϵ and dominated by the helicity cascade (spectrum $H(k) \sim k^{-h}$, transfer $\tilde{\epsilon}$). This points to the existence of a new small parameter, $\epsilon/[L_0\tilde{\epsilon}]$, with L_0 a characteristic length. We also find that $e + h = 4$, taking into account the inertial wave mediation of nonlinear helicity transfer to small scales, with $e \neq h$ at the intermediate Reynolds numbers at which we compute. Using an isotropic model based on the Eddy Damped Quasi-Normal Markovian closure, and including the contribution of helicity to eddy viscosity and eddy noise, we show that we can recover the DNS results at substantially lower costs and that, at fixed Reynolds number, strong rotation leads to the $e + h = 4$ regime whereas $e = h = 5/3$ when increasing the Reynolds number at fixed rotation rate.

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Date submitted: 28 Jul 2010 Electronic form version 1.4