1051-76-53 **Annick Pouquet*** (pouquet@ucar.edu), PO Box 3000, Boulder, CO 80307, and **Julien Baerenzung**, **Pablo Mininni** and **Duane Rosenberg**. *Combining rotation and helicity in turbulent flows and the emergence of strong and persistent cyclonic columnar vortices.*

Rotation, measured by the Rossby number Ro, is important in geophysics. When rapid, weak turbulence prevails but at high Reynolds number Re, this regime breaks down.

The effect of helicity, measuring departures from mirror symmetry, unclear without rotation, is significant at low *Ro*. Using direct numerical simulations with 1536^3 grid points, we show the occurence of long-lived laminar cyclonic vortices together with turbulent vortices, reminiscent of recent tornado observations but in a simpler physical context. The small-scale energy cascade (of spectrum $\sim k^e$ and transfer rate μ) is self-similar with no deviations from Gaussianity and dominated by the helicity cascade (of spectrum $\sim k^h$ and transfer rate ν). This points to the discovery of a new small parameter in rotating helical turbulence, $\sim \mu/\nu$. We also find that the spectral indices obey $e + h = -4$ when taking into account the inertial wave mediation of nonlinear transfer to small scales.

We then perform a parametric study, using a subgrid model with helical transport coefficients, up to Re$\sim 10^5$ and down to Ro ~ 0.005. At fixed Re, strong rotation leads to this new regime, whereas one recovers the Kolmogorov law when increasing Re at fixed rotation rate. (Received August 07, 2009)