# Waves, eddies and helicity in rotating turbulent flows.

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Invariants of the equations of motion play an essential role in the behavior of turbulent flows. The cascade of energy to small scales in three dimensional hydrodynamic turbulence, associated with the conservation of energy in the ideal case, is a well-known example. Less understood is the role played by helicity, which embodies the global correlations between the velocity field and the vorticity. Helicity is a curious invariant of the Euler equations in three dimensions, which measures topological complexity of the flow and departures from mirror symmetry, but which is also observed to play an important role in the generation of large-scale magnetic fields in astrophysics, and hypothesized to play a stabilization role in atmospheric processes.

In this talk I will first review results on non-helical rotating turbulence from wave turbulence theory, and compare the predictions of the theory with results from large direct numerical simulations (DNS) of rotating turbulent flows. An analysis based on Eulerian time correlation functions will be also used to make connections between the results of the DNS with strong wave turbulence, weak turbulence theory, and with isotropic turbulence. Then, I will present some situations in which helicity is believed to be important, and try to identify its effect on the flow evolution. In the case or rotating flows, helicity in the flow affects scaling laws, both in the strong and weak turbulence regimes. This in turn affects the decay of turbulence, and the mixing of scalar quantities. Extensions of these results to other systems, and possible experimental measurements, will be briefly discussed.