# Energy cascade in rotating turbulent flows

Turbulent flows under strong rotation exhibit fascinating phenomena which can be appreciated in the might of convective storms, in the awe-inspiring swirls in Jupiters Big Red Spot, in the beautiful structures seen in experiments and in many other instances. Despite the huge number of theoretical, numerical and experimental investigations, it is not yet comprehended what are the main dynamical and statistical mechanisms leading to the transition from a quasi-isotropic evolution to a strongly-anisotropic behavior with elongated structures, as empirically observed when the rotation rate is increased. Rotating turbulence is the result of the intricate interactions between quasi 2D motions with 3D fast wave propagations, coupled with strong small-scale turbulent fluctuations. The outcome is a split-energy cascade going both forward and backward from the scale where it is injected. The need to resolve two range of scales leads to extremely demanding resources for Direct Numerical Simulations (DNS) approaches. Thanks to the Prace-17th project we performed state-of-the-art DNS where we spanned two different control parameters, the rotation frequency and the aspect ratio of the flow domain, with unprecedented accuracy. This work allowed us to explore regions of the system's phase-space never reached before and to reveal unknown physical properties of turbulence under rotation never observed before neither by experiments nor by simulations. These results will impact in problems broader than the case of flows under rotation, as Wave Turbulence is a basic approach for many other configurations, such as internal gravity waves in stratified flows, surface waves, acoustic waves, Alfven waves in conducting flows, to cite just a few of the most important ones.