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**Statistical Equilibrium and Inverse Cascades of vortical modes for rotating and stratified flows** CORENTIN HERBERT, RAFFAELE MARINO, ANNICK POUQUET, National Center for Atmospheric Research, TURBULENCE NUMERICS TEAM — Most turbulent flows appearing in nature are subjected to strong rotation and stratification. These effects break the symmetries of homogenous isotropic turbulence. In doing so, they introduce a natural decomposition of phase space in terms of wave modes and potential vorticity modes. The appearance of a new time scale associated to the propagation of waves increases the complexity of the energy transfers between the various scales; nonlinearly interacting waves may dominate at some scales while balanced motion may prevail at others. In the end, it is difficult to predict if the energy cascades downscale as in homogeneous isotropic turbulence, upscale as expected from balanced dynamics, or follows yet another phenomenology. In this contribution, we suggest a theoretical approach based on equilibrium statistical mechanics for the ideal system. We show that when the dynamics is restricted to the vortical modes, the equilibrium spectrum features an infrared divergence characteristic of an inverse cascade regime. This can be interpreted as a metastable state for the full system. We discuss how the waves are expected to deflect the energy cascade, for purely rotating, purely stratified and rotating-stratified flows, finally leading to inverse or direct cascade scenarios.

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