Abstract Submitted
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Vorticity alignment and spectral statistics in a variable-density turbulent flow[1] ILANA GAT, California Institute of Technology, GEORGIOS MATHEOU, California Institute of Technology, NASA Jet Propulsion Laboratory, DANIEL CHUNG, University of Melbourne, PAUL DIMOTAKIS, California Institute of Technology — Turbulent flows with high density gradients subject to an externally imposed acceleration field, such as gravity, occur in many phenomena, ranging from geophysics to astrophysics. This study investigates turbulence in fluids over a range of density ratios, from small (R=1.005) to large (R=10). The investigation relies on direct numerical simulation using the incompressible variable-density Navier-Stokes equations, in a triply periodic domain. The flow is initialized with density gradients perpendicular to the acceleration field. This configuration induces baroclinic torques with shear and buoyancy contributing to the evolution of turbulence and turbulent mixing. Of interest in fluid modeling is vorticity alignment, which is presented for the broad density ratio range studied. Prominent variable-density contributions to the vorticity field such as baroclinic torques are discussed. Kinetic-energy spectra are compared to specific kinetic energy spectra to illustrate aspects of variable-density effects.

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