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The Dynamics of Stratified Horizontal Shear Flows at Low Pclet Number LAURA COPE, DAMTP, University of Cambridge, PASCALE GARAUD, UC Santa Cruz, COLM-CILLE CAULFIELD, DAMTP, University of Cambridge — Stratified flows are ubiquitous; examples include atmospheres and oceans in geophysics and stellar interiors in astrophysics. The interaction of a stable stratification with a background velocity distribution can develop into stratified turbulence, key to transport processes in many systems. Geophysical flows, in which the Prandtl number $Pr \sim O(1)$, are often strongly stratified, nevertheless, turbulence still occurs. Density layering is key to understanding the properties of this layered anisotropic stratified turbulence (LAST) regime that is characterised by anisotropic length scales and velocity fields. Conversely, $Pr \ll 1$ for astrophysical flows, inhibiting the formation of density layers. This suggests that LAST dynamics cannot occur, raising the question of whether analogous or fundamentally different regimes exist in the limit of strong thermal diffusion. This study addresses this question for the case of a vertically stratified, horizontally-forced Kolmogorov flow using a combination of linear stability theory and direct numerical simulations. Four distinct dynamical regimes emerge, depending upon the strength of the background stratification. By considering dominant balances in the governing equations, we derive scaling laws which explain the empirical data.

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