Abstract Submitted
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Nonlinear interactions between an unstably stratified shear flow and an evolving phase boundary[1] SRIKANTH TOPPALADODDI, University of Oxford — Well resolved numerical simulations are used to study Rayleigh-Bénard-Poiseuille flow over an evolving phase boundary for moderate values of Péclet ($Pe \in [0, 200]$) and Rayleigh ($Ra \in [2.15 \times 10^3, 10^6]$) numbers. The relative effects of mean shear and buoyancy are quantified using a bulk Richardson number: $Ri_b = Ra \cdot Pr/Pe^2$, where Pr is the Prandtl number. For $Ri_b \ll 1$, we find that the Poiseuille flow inhibits convective motions, resulting in the heat transport being only due to conduction. In the opposite limit of $Ri_b \gg 1$, the flow properties and heat transport closely correspond to the purely convective case. We also find that for $Ri_b = O(1)$ there is a pattern competition for convection cells with a preferred aspect ratio. Furthermore, we find travelling waves at the solid-liquid interface when $Pe \neq 0$, in qualitative agreement with other sheared convective flows in the experiments of Gilpin *et al.* (*J. Fluid Mech* **99**(3), pp. 619-640, 1980) and the linear stability analysis of Toppaladoddi and Wettlaufer (*J. Fluid Mech.* **868**, pp. 648-665, 2019).

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