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Pseudo-Turbulence in Buoyancy-Driven Bubbly Flows VIKASH PANDEY, RASHMI RAMADUGU, PRASAD PERLEKAR, TIFR Centre for Interdisciplinary Sciences, Tata Institute of Fundamental Research, Hyderabad, 500107, India — Bubbly flows occur in a variety of natural and industrial processes. We present a direct numerical simulation (DNS) study of pseudo-turbulence in buoyancy-driven bubbly flows for a range of Reynolds ($150 < \mathrm{Re} < 546$) and Atwood ($0.04 < \mathrm{At} < 0.9$) numbers. We study the probability distribution function of the horizontal and vertical liquid velocity fluctuations and find them to be in quantitative agreement with the experiments. The energy spectrum shows a k^{-3} scaling at high Re and becomes steeper on reducing Re. To investigate spectral transfers in the flow, we derive the scale-by-scale energy budget equation. Our analysis shows that, for scales smaller than the bubble diameter, the net transfer because of the surface tension and the kinetic energy flux balances viscous dissipation to give k^{-3} scaling of the energy spectrum for both low and high At.

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