Generation of helicity by salt-fingers

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Abstract

Recently it was shown that in salt-fingering convection, symmetry breaking is observed, quantified by the spontaneous generation of helicity (1). In unstably-stratified turbulence, it was shown that a similar effect can be understood in the two-dimensional, three-component limit (2).

In this communication, we show by linear analysis that, analogously to unstably stratified turbulence, in double-diffusive convection in the salt-fingering regime, helicity can be generated in a well-defined region of parameter space, relevant for the dynamics in planetary cores (3).

This finding provides not only a possible theoretical explanation for the spontaneous emergence of helicity, observed in recent numerical simulations (1), but also suggest that helical salt-fingering might be considered as a mechanism to excite and sustain planetary dynamos.

(1) A. E. Fraser, A. van Kan, E. Knobloch, K. Julien, and C. Liu. Spontaneous generation of helicalflows by salt fingers. Journal of Fluid Mechanics, 1020:R1, 2025.

(2) W. Agoua, B. Favier, A. Delache, A. Briard, and W.J.T. Bos. Spontaneous generationand reversal of helicity in anisotropic turbulence. Physical Review E, 103(6):L061101, 2021

(3) S. Varghese, B. Miquel, W.J.T. Bos; Generation of helicity by salt-fingers in the two-dimensional three-component limit. Submitted (2025).

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