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Mixed-mode instability of a miscible interface due to coupling between Rayleigh-Taylor and double-diffusive convective modes JORGE CARBALLIDO-LANDEIRA, PHILIP TREVELYAN, CHRISTOPHE ALMARCHA, ANNE DE WIT, Non Linear Physical Chemistry Unit, Université Libre de Bruxelles — In a gravitational field, a horizontal interface between two miscible fluids can be buoyantly unstable because of double diffusive effects or because of a Rayleigh-Taylor instability arising when a denser fluid lies on top of a less dense one. We show here both experimentally and theoretically that, besides such classical buoyancy-driven instabilities, a new mixed mode dynamics exists when these two instabilities act cooperatively. This is the case when the upper denser solution contains a solute A, which diffuses sufficiently faster than a solute B initially in the lower layer to yield non-monotonic density profiles after contact of the two solutions. We derive analytically the conditions for existence of this mixed mode in the (R, δ) parameter plane, where R is the buoyancy ratio between the two solutions and δ is the ratio of diffusion coefficient of the solutes. We find an excellent agreement of these theoretical predic- tions with experiments performed in Hele-Shaw cells and with numerical simulations.

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