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Spontaneous layer formation dynamics in stratified Taylor–Couette flow[1] COLIN LECLERCQ, University of Bristol, JAMIE L. PARTRIDGE, DAMTP, University of Cambridge, PIERRE AUGIER, LEGI (Grenoble), CNRS, C.P. CAULFIELD, BP Institute and DAMTP, University of Cambridge, PAUL F. LINDEN, STUART B. DALZIEL, DAMTP, University of Cambridge, MUST COLLABORATION — The spontaneous formation of horizontal layers is a common feature of strongly and stably stratified flows and plays a major role in the dynamics of geophysical flows. However, little is known about the physical mechanism setting the depth of the layers spontaneously emerging in "stratified Taylor–Couette flow" in the annulus between a rotating inner cylinder and a fixed outer cylinder, initially filled with stably, axially and linearly stratified fluid. Using linear stability analysis, direct numerical simulations and experiments, we investigate the relative importance of primary linear instability and secondary nonlinear processes in the transient dynamics leading to the experimentally and numerically observed step-like density profile in this flow. We explore the effects of the particular form of the spin-up of the inner cylinder and initial conditions on the transient dynamics and nonlinear attractor of the flow. By better understanding the dynamics of layer formation, we are able to identify the approriate scaling laws relating layer depth to rotation rate, initial stratification, gap width and radius ratio.

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