Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Saffman-Taylor Instability and the Inner Splitting Mechanism RAFAEL OLIVEIRA, Pontifícia Universidade Católica, Rio de Janeiro, ECKART MEIBURG, University of California, Santa Barbara — The classical miscible displacement experiments of Wooding (1969) exhibit an inner splitting phenomenon that remained unexplained for over 40 years. 3D Navier-Stokes simulations presented in J. Fluid Mech. 687, 431-460 (2011), were the first ones to reproduce these experimental observations numerically, and to demonstrate that they are linked to concentrated streamwise vortices. The origin of these concentrated streamwise vortices remained a mystery, however. The current investigation, published at Phys. Rev. Lett. 118, 124502 (2017), finally resolves this long-standing issue. Towards this end, we compare 3D Navier-Stokes simulation results for neutrally buoyant, viscously unstable displacements and gravitationally unstable, constant viscosity ones. Only the former exhibit the generation of streamwise vorticity. The simulation results present conclusive evidence that it is caused by the lateral displacement of the more viscous fluid by the less viscous one, with the variable viscosity terms playing a dominant role.

Rafael Oliveira
Pontifícia Universidade Católica, Rio de Janeiro

Date submitted: 17 Jul 2017 Electronic form version 1.4