Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Streaming patterns in Faraday waves PABLO GUTIERREZ, NICOLAS PERINET, Universidad de Chile, HECTOR URRA, Pontificia Universidad Catolica de Valparaiso, NICOLAS MUJICA, Universidad de Chile, LEONARDO GORDILLO, University of Minnesota — Wave patterns in the Faraday instability have been studied for decades. Besides the rich wave dynamics observed at the interface, Faraday waves hide elusive flow patterns in the bulk –the streaming patterns– that have not been studied in detail until now. We analyse these streaming flows by conducting experiments in a Faraday-wave setup. To visualize the flows, we perform stroboscopic measurements: tracers are used to generate both trajectory maps and to probe the streaming velocity field via PIV. We identify three types of patterns that can coexist under identical Faraday waves. Next we propose a three-dimensional model that explains streaming flows in quasi-inviscid fluids. We show that the streaming inside the fluid arises from a complex coupling between the bulk and the boundary layers. This coupling can be taken into account by applying modified boundary conditions in a three-dimensional Navier-Stokes formulation for the streaming in the bulk. Numerical simulations based on this theoretical framework show good agreement with experimental results. Simulations reveal that the variety of experimental patterns is linked to the boundary condition at the top interface, which may be strongly affected by the presence of contaminants along the surface.

Pablo Gutierrez
Universidad de Chile

Date submitted: 29 Jul 2016 Electronic form version 1.4