Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Faraday instability in electrostatically forced liquid-air systems[1]
KEVIN WARD, Univ. of Florida, FARZAM ZOUESHTIAGH, Institut dElectronique, de Microlectronique et de Nanotechnologie (IEMN), UMR CNRS 8520, University of Lille 1, SATOSHI MATSUMOTO, Institute of Space and Astronautical Science Japan Aerospace Exploration Agency, RANGA NARAYANAN, Univ. of Florida — When stacked multi-fluid systems are periodically accelerated in a direction normal to the fluid interfaces, complex patterns on the interfaces develop as a result of resonance between the imposed oscillation frequency and the natural frequency of the system, a phenomenon known as Faraday instability. Experimental research at JAXA has successfully generated Faraday instability in electrostatically oscillated liquid-air systems constrained radially by insulating sidewalls and axially by externally controlled electrodes. In this work, we present the design and methodology for electrostatically oscillated experiments, experimentally determined stability curves, and the distinctions and commonalities between mechanically and electrostatically forced Faraday systems. Multiple geometries are examined in order to illustrate the effects of aspect ratio and sidewall boundary conditions. Pure AC forcing and AC forcing with a DC offset are both discussed. Videos of the generated patterns are shown and compared to theoretical predictions of their corresponding Faraday mode shapes. Subharmonic responses with respect to the base state oscillation of the system are observed upon the onset of the instability, a feature indicative of parametric instabilities.

[1]Supported by NSF 0968313, CASIS NNH11CD70A, NSF EAPSI 1514711, NSF DGE-1315138.

Kevin Ward
Univ of Florida - Gainesville

Date submitted: 27 Jul 2015 Electronic form version 1.4