Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Modelling of hydrothermal instabilities in a capillary bridge[1]
DIPIN PILLAI, University of Florida, ALEX WRAY, University of Strathclyde, RANGA NARAYANAN, University of Florida — We examine the behaviour of a capillary bridge/boat suspended between two heated plates. Such systems are common in many physical situations such as crystal growth processes. However, as shown experimentally by Messmer et al. [1], the system exhibits a complex array of behaviours driven by a Marangoni instability. While qualitative arguments have been advanced for these behaviours in the past, we develop a complete low-order model to elucidate the mechanisms at work. The model takes into account viscosity, surface tension, Marangoni stress and inertia as well as a full convection-diffusion equation for the thermal effects. Detailed comparisons of flow fields and thermal distributions are made with experiments.
[1] B. Messmer, T. Lemee, K. Ikebukuro, I. Ueno, and R. Narayanan, "Confined thermo-capillary flows in a double free-surface film with small Marangoni numbers." International Journal of Heat and Mass Transfer 78 (2014): 1060-1067.

[1]NASA NNX17AL27G and NSF 0968313

Alexander Wray
University of Strathclyde

Date submitted: 30 Jul 2017 Electronic form version 1.4