Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

**Free-surface deformation of a liquid bridge** BRENT HOUCHENS, Rice University, JOHN WALKER, University of Illinois, Urbana-Champaign —
Several groups have predicted free-surface deformations in thermocapillary driven liquid-bridge flows. In problems such as the half-zone, the temperature dependent surface tension confines the fluid, forming a liquid bridge between two solid cylinders, held at different temperatures. The shape of the free-surface influences the flow, and vice-versa. In even the simplest case, where buoyancy is neglected and the flow is axisymmetric, there is disagreement between predictions with respect to the free-surface shape. Furthermore, few models include the effect of dynamic pressure, which is non-negligible under microgravity conditions. To classify the discrepancies in the models, we investigate a half-zone in which the reference surface tension is large compared to the thermocapillary induced variations. Combined with a microgravity environment, these conditions produce a nearly cylindrical liquid bridge. Therefore, we calculate the flow corresponding to a cylindrical free-surface, and then allow for small surface-shape perturbations. Applying asymptotic expansions, we predict the leading order corrections to the free-surface velocity and deformation. This solution is very efficient and stable as compared to numerical schemes which iterate between the flow field and free-surface shape. It also offers insight into the relevance of each term, including the dynamic pressure variation.

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Date submitted: 05 Aug 2005 Electronic form version 1.4