Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Reverse Marangoni Propulsion of Disks and Hemispheres at Finite Reynolds Numbers[1] SAMRAT SUR, University of Massachusetts - Amherst, HASSAN MASOUD, Michigan Tech, JONATHAN ROTHSTEIN, University of Massachusetts - Amherst — In this presentation, the experimentally observed phenomenon of Reverse Marangoni propulsion will be presented for both a thin cylindrical disk and a hemisphere floating on an air-water interface. Each particle was propelled by an asymmetric release of a surfactant to locally reduce the surface tension. Marangoni surfers typically propel themselves forward in the direction of high surface. However, by systematically varying the water depth we will show that increasing confinement initially causes the velocity of the Marangoni surfer to slow, then come to rest and finally to reverse direction resulting in the Marangoni surfers moving in the direction of lower surface tension. Particle tracking and PIV measurements will be used to measure flow field induced by Marangoni flow underneath the disk and hemisphere and understand the origin of the reverse Marangoni flow. This phenomenon of reverse Marangoni flow has been predicted theoretically for Stokes flow at zero Reynolds number. We will show that the reverse Marangoni motion is not only dependent on the water depth confinement but also on Reynolds number. With increasing Reynolds number, increased confinement is needed to observed reverse Marangoni flow. These experimental results are in excellent agreement with the prediction of numerical simulations.

[1]NSF CBET 1705519

Jonathan Rothstein
University of Massachusetts - Amherst

Date submitted: 29 Jul 2019 Electronic form version 1.4