Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Droplet Encapsulation VATSAL SANJAY, UTKARSH JAIN, MAZIYAR JALAAL, DEVARAJ VAN DER MEER, DETLEF LOHSE, Physics of Fluids Group, University of Twente — When a millimetric water drop is gently deposited on a silicone oil bath, it reaches a temporarily stable shape supported by a thin lubricating air layer. Upon the drainage of this layer, a triple contact line (between air, water, and oil) forms. Owing to the positive spreading coefficient of silicone oil, it tries to maximize its surface area. This configuration results in encapsulation of droplet by the liquid pool. We focus on the temporal dynamics of the encapsulation process.

We study the problem using experiments and numerical simulations. In experiments, we use high-speed imaging at 50k fps to capture the process of encapsulation. In simulations, we first find the initial static shape of the droplet by using the Young-Laplace equation. We then solve the Navier-Stokes equations using a Finite Volume Method implemented by [Popinet 2014, Basilisk, http://basilisk.fr]. We have modified this numerical framework to solve for the triple contact line implicitly.

The present work provides information on the physics of the interaction of droplets with a free surface and presents a new methodology for modeling triple contact lines. This method can be used in a wide range of applications involving three immiscible liquids.

Vatsal Sanjay
Physics of Fluids Group, University of Twente

Date submitted: 29 Jul 2019 Electronic form version 1.4