Interfacial dynamics: droplets and suspensions

In this talk, we will present two projects that pertain to fluid dynamics of fluid-fluid interfaces. In the first part of the talk, we experimentally and theoretically demonstrate the effect of air flow that is applied normal to an initially stagnant water droplet deposited on a solid surface. Reminiscent of the drying process in printing, the droplet exhibits complex behaviors — splitting and depinning, depending on the strength and configuration of the applied wind. A mathematical model qualitatively captures the evolution of the 2D thin drop, and this splitting transition by combining the potential flow and Prandtl boundary layer theory.

In the second part, we report a particle-induced interfacial instability when a particle-oil mixture is injected between two parallel plates, thinly coating them. Our experimental results show that the onset and characteristics of fingering are most directly affected by the particle volume fraction but also depend on the ratio of the particle diameter to gap size. This work demonstrates the complex coupling between suspensions and fluid-fluid interfaces and has broad relevance in suspension processing, particle self-assembly, and various coating flows.

Wednesday, February 27
3:15 - 4:15 p.m.
RNS 210
Cookies and Apple Cider Served!

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Professor Lee is a Benjamin Mayhugh Assistant Professor in Mechanical Engineering at the University of Minnesota. She completed her Ph.D. and M.S. in Mechanical Engineering at Massachusetts Institute of Technology, and B.S. in Mechanical Engineering at University of California, Berkeley. Following a post-doc at Ecole Polytechnique and adjunct faculty position in Applied Math at University of California, Los Angeles, she was an assistant professor in the Mechanical Engineering at Texas A&M University from 2013-2017. Dr. Lee's fluid mechanics research group specializes in reducing complex physical phenomena into tractable problems that can be visualized with table-top experiments and solved with mathematical modeling. The physical systems of interest range from drops and bubbles, particle-laden flows, to two-phase flows through porous media and are strongly motivated by applications in the area of energy, environment and material science.