Oscillations of the sessile drop are of fundamental interest in a number of industrial applications, such as ink-jet printing and drop atomization. We generalize the stability analysis for the free inviscid drop (Rayleigh, 1879), focusing on the wetting properties of the solid substrate and mobility of the three-phase contact-line. We report oscillation frequencies and modal structures for the `symmetry-broken’ Rayleigh drop that display spectral splitting/reordering and compare with experiments. To organize and explain the hierarchy of frequencies, we construct a corresponding ‘periodic table of mode shapes’ from the spectral data. In addition to the oscillatory spectrum, we report a new hydrodynamic instability that has fundamental implications for fluid transport.

About the speaker: Dr. Bostwick’s research addresses fundamental problems in fluid transport with an emphasis on surface tension related phenomena. He received his PhD from Cornell University in 2011. His dissertation work largely focused on developing a mathematical formalism to study the hydrodynamic stability of fluids in contact with partially-wetting solid substrates, such as droplets, rivulets and liquid bridges. In 2011, he began his postdoc at NC State working on problems in thermocapillary-driven thin film flows, fracture of soft solids, and elastocapillarity. Currently, he is the Golovin Assistant Professor in the Department of Engineering Science and Applied Mathematics at Northwestern University.

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