Special Program in Applied Mathematics and Applied Mechanics

Dynamics of Sessile Drops

Prof. Chun-Ti Chang

2016 - 09 - 21 (Wed.)
15:00 - 18:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

This talk presents a series of experiments with mechanically vibrated sessile drops. The experiments examine the shape, frequency and amplitude responses of resonating sessile drops for individual modes. The modes are identified by their geometric features. The frequency responses are characterized by relating to Rayleigh-Lamb (RL), Bostwick-Steen invisid (BS inviscid) and Bostwick viscous potential flow (VPF) theories. The VPF theory turns out to be the most adequate model. This implies the necessity of including both substrate constraint and viscosity, and hence distinguishes viscous sessile drops from and inviscid free spherical drops. The amplitude responses of modes are explored from the growth and decay of the lowest axisymmetric mode. Significant hysteresis is revealed. Further exploration reveals the interactions of modes such as spectral crossing and mode mixing. Subhemispherical drops typically show mixtures of a half-frequency subharmonic non-zonal mixing a harmonic zonal mode. Superhemispherical drops exhibit more diverse mode mixing. Scientifically, the study reveals a rich collection of modes catagorized according to shapes and harmonic types for future investigation. For engineers, the study provides guidelines for applications relevant to pattern selection of surface waves, such as ordered self-assembly of nanoparticles, droplet transport, drop atomization, enhanced mixing, and suspension collection.