Abstract for an Invited Paper
for the DFD10 Meeting of
The American Physical Society

Single vesicle dynamics in various flows: Experiment versus theory

VICTOR STEINBERG, Weizmann Institute of Science

Dynamics of a single vesicle in shear, elongation, and general flows is investigated experimentally. Phase diagram of three vesicle dynamical states is obtained experimentally in both shear and general flows. The new control parameter, the ratio of the vorticity to the strain rate ω/s, allows following an experimental path, which scans across the whole phase diagram with a single vesicle. Surprisingly, all three states and transitions between them are obtained on the same vesicle and at the same viscosity of inner and outer fluids. We reveal the physical nature of the key dynamical state, coined by us trembling, which shows up in intrinsic shape instability on each cycle resulted in periodical bursting of higher order harmonics depending on the value of the control parameter proportional to ω/s. The dynamics of trembling state is compared with dynamics of a vesicle a time-dependent elongation flow, where the wrinkling instability was discovered, and similar features are identified. Quantitative comparison with recently proposed models and numerical simulations for vesicle dynamics is reviewed.