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Experimental and theoretical investigation of capillary oscillations of a charged droplet levitated using various applied waveforms NEHA GAWANDE, MOHIT SINGH, Y.S. MAYYA, ROCHISH THAOKAR, Indian Institute of Technology Bombay, Mumbai — A conducting charged droplet levitated in a quadrupole trap becomes unstable when the surface charge on the droplet exceeds its Rayleigh limit. However, when the charge on the droplet is in the sub-Rayleigh limit, it exhibits capillary oscillations whose amplitude and frequency depend upon the magnitude of the charge as well as on the applied electric field. In this work, we present the high-speed imaging of the surface oscillations of a highly charged droplet levitated using various applied waveforms such as sine, square and ramp wave. The surface dynamics is characterized by Fast Fourier Transformation (FFT) analysis and it is observed that the droplet oscillates with the applied frequency irrespective of the type of the waveform. To understand the experimental observation an asymptotic theory is carried out for a perfectly conducting charged droplet in the potential flow limit with viscous corrections. The analysis suggests that the droplet oscillation behavior is the result of complex interplay between the dipolar charge distribution on the drop and the local uniform electric field acting due to off-centered position of the droplet within the trap.

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