Monitoring droplet dynamics of a levitated droplet.

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Abstract:

The study of liquids in the form of levitated droplets without any external contact (e.g. with the substrate) is important for precise analysis of liquids. Acoustic levitation offers a unique method to suspend liquid droplets, allowing for precise control and observation free from container walls [1]. This capability is crucial for investigating the evaporation dynamics of droplets, which is relevant to various fields such as material science, pharmacology, and environmental science. In this study, an acoustic levitator [2] is used to suspend a droplet of packaged drinking water from four different companies. Free levitated droplets due to the interaction with acoustic waves could change horizontal position and the droplet's shape could also change [3].

The droplet was suspended by a set of acoustic inducers, and its behaviour was recorded using two Raspberry HQ cameras positioned orthogonally to each other. This dual-camera setup made it possible to draw the three-dimensional shape information and movement of the droplet, ensuring precise measurements of its volume dynamics with time. The dynamics of the droplet were further studied by tracking the x and y coordinates of its centre using image processing libraries with Python 3. This analysis provides an understanding of the stability and movement of the droplet within the levitation field. The experiment was conducted for droplets of different sizes and the change in shape and positions were observed. These changes are critical for understanding the evaporation process and the forces at play in a levitated environment. The ability to monitor volume changes and droplet dynamics without external interference helps to study the behaviour of complex fluids and colloidal systems more accurately.

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