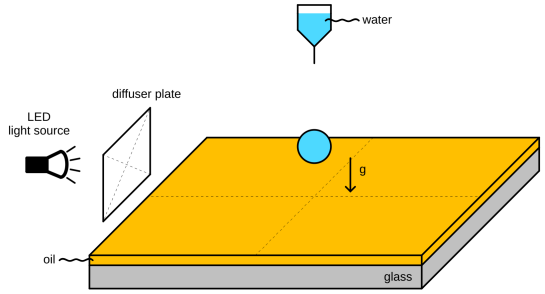
Bouncing drops on oil coated surfaces

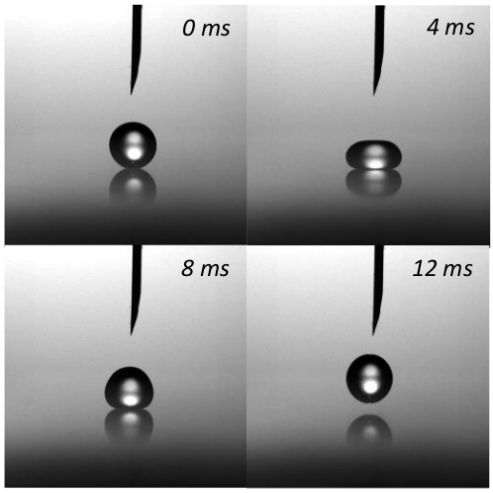
Description

Liquid drops impacting a dry surface can have different impact outcomes [1], eg. deposition, bouncing, splashing. At low impact speeds, it is observed that, drops can bounce over a thin film of air, where, large viscous forces provided by thin film of air reverses the direction of the impacting drop. However, the bouncing process is not sustained indefinitely, since, a small amount of energy is lost in every bounce event which eventually brings the droplet to rest.

Present experiments focuses on energy budget analysis of liquid drops bouncing (over air film) on oil coated surfaces. Here, the impact energy is lost in the impacting liquid droplet, thin film of air and in the oil film, the contributions of which are not well understood. An experimental schematic of the setup is shown in Figure 1a. A typical bouncing event is shown in Figure 1b. In our experiments, we will measure the restitution coefficient (ratio of the droplet velocity after and before impact) from side-view visulizations, which would help in understanding the energy loss mechanism.



(a) Experimental setup schematic



(b) Side-view visualizations

Figure 1: Experimental setup and visualizations of a bouncing process

The prospective student can choose to do experiments* or computations+ in the project.
In the course of the experimental project he/she will learn,

a) Spincoating silicone-oil film on dry glass surfaces. Measure oil film thickness using *Spectrometer*.

b) Side-view visualizations using high speed camera. *Shadowgraphy* visualization as in Figure 1b.

c) Image processing and analysis. Programming language like *Python* (or *MATLAB*) will be used.

The prospective student will closely work with some *Digital Holographic Microscopy* and *Color interferometry* experiments by Srinath Lakshman and *Volume Of Fluids* simulations by Vatsal Sanjay.

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References

1. Yarin, A.L., 2006. Drop impact dynamics: splashing, spreading, receding, bouncing, ... Annu. Rev. Fluid Mech., 38, pp.159-192.