ME Seminar

Dr. Sunil Kumar Saroj, ESPCI Paris, France

Part 1: Atomization of an acoustically levitated droplet: Experimental observations of myriad complex phenomena

ABSTRACT: This study reports the dynamics of a droplet levitated in a single-axis acoustic levitator. The deformation and atomization behavior of the droplet in the acoustic field exhibits a myriad of complex phenomena, in sequences of steps. These include the primary breakup of the droplet through stable levitation, deformation, sheet formation, and equatorial atomization, followed by a secondary breakup, which could be an umbrella, bag, bubble breakup or multistage breakup, depending on the initial size of the droplet. The visualization of the interfacial instabilities on the surface of the liquid sheet using both side and top-view imaging is presented. The secondary breakup exhibits Weber number dependency and includes umbrella, bag, bubble, or multistage types, ultimately resulting in complete atomization of the droplets. Both the primary and the secondary breakup of the droplet admit interfacial instabilities such as Faraday instability, RT instability, and RP instability and are well described with visual evidence.

Part 2: Experimental investigation to test the static bell's inequality in a hydrodynamic system

ABSTRACT: A sub-millimetric bouncing droplet can walk on the surface of the fluid due to the resonant interaction with its own wave field. The present presentation will concentrate on the experimental investigation of the wave coupling behavior of two droplets bouncing in two different cavities and their associated trajectory. The center distance (L) between the cavities and memory both affect the trajectories. A strong wave coupling has been observed between the two droplets for a fixed L at smaller memory. It has been observed that the higher memory exhibits chaotic motion, suggesting a weak wave coupling between the two droplets. Several previous studies reported that the walking droplet can mimic the wave particle duality phenomena reminiscent of the quantum-like behaviors Therefore, we have used this analogy to test the violation of the static bell's inequality in this hydrodynamic framework.

ABOUT THE SPEAKER

Currently, I am working as a postdoctoral researcher at ESPCI-Paris PSL research university France. Here, I am working on 'Experimental investigation to test the static bell's inequality in a hydrodynamic system'. I received my Bachelor's degree in Mechanical Engineering from Uttar Pradesh Technical University. I pursued my Master's degree in Mechanical Engineering at IIT Kanpur from 2013-2015. During my M. Tech, I have worked on magnetic actuation based mixing enhancement inside the micron size droplet. I did my Ph.D. in the department of mechanical engineering at IIT Kanpur with Prof. P. K. Panigrahi from 2015 to 2021. My Ph.D. research was focused on the magnetically controlled deposition pattern of evaporating droplet and heat management (thermal switch). I did my first postdoc in the Department of chemical engineering with Prof. Rochish M. Thaokar at IIT Bombay. My research at IIT Bombay was focused on the atomization of acoustically levitated droplet. My research interests include Microfluidics, droplets and interfaces, magneto flow control, heat management, micromixing, micro-PIV, magnetic drug targeting, breakup of acoustically levitated droplets and bouncing droplets on the vibrating bath.

May 24, 2024, 4:00 pm, Microsoft Teams (ONLINE)