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

Sunil Kumar Saroj[1,2], Stéphane Perrard[2], Matthieu Labousse[1]

[1] Gulliver, CNRS, ESPCI Paris, Université PSL, 75005, Paris, France
[2] PMMH, CNRS, ESPCI Paris, Université PSL, Sorbonne Université, Université de Paris, 75005, Paris, France
sunil.kumar-saroj@espci.fr

A sub-millimetric bouncing droplet can walk on the surface of the fluid due to the resonant interaction with its own wave field [1]. The present experimental study investigates the wave coupling behavior of two droplets bouncing in two different cavities and their associated trajectory.

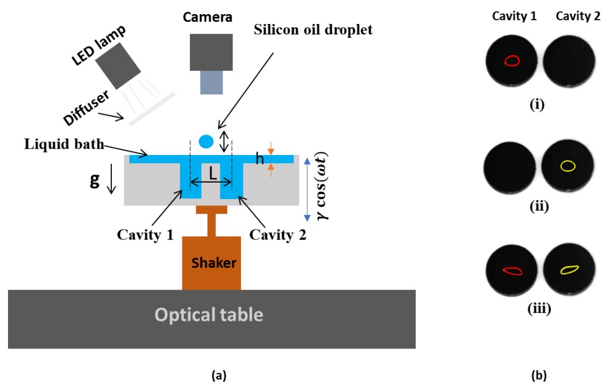

Figure 1. (a) Sketch of the experimental arrangement and (b) trajectories of the droplets : (i) droplet present in cavity 1, (ii) droplet present in cavity 2 and (iii) droplets present in both cavities .

Figure 1 (a) illustrates the experimental arrangement of a vibrating bath with two cavities submerged in it. The center distance (L) between the cavities and memory both affect the trajectories. For example : the circular trajectory when a droplet is bouncing in the cavity 1 (see figure 1 (b) i). The trajectory is exactly identical if the droplet from cavities 1 is transferred to the cavity 2 (see figure 1 (b) ii). The trajectories are modified when the droplet present in both the cavities (see figure 1 (b) iii). This is due to the mediated wave interaction between two droplets that bounce into their respective cavities [2]. This correlation between two droplets is significantly affected by the L and memory of the droplet. 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 [3]. Therefore, we have used this analogy to test the violation of the static bell's inequality in this hydrodynamic framework.

Références

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