ESPCI
Laboratoire PMMH
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Séminaire PMMH

Bureau d'Études, Bâtiment L, 2 ème étage

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Scattering theory for walking droplets in the presence of obstacles

Walking droplets that are sustained on the surface of a vibrating liquid, have attracted considerable attention during the past decade due to their remarkable analogy with quantum wave-particle duality. This was initiated by the pioneering experiment by Y. Couder and E. Fort in 2006, which reported the observation of a diffraction pattern in the angular resolved profile of droplets that propagated across a single slit obstacle geometry. While the occurrence of this wave-like phenomenon can be qualitatively traced back to the coupling of the droplet with its associated surface wave, a quantitative framework for the description of the surface-wave-propelled motion of the droplet in the presence of confining boundaries and obstacles still represents a major challenge. This problem is all the more stimulating as several experiments have already reported clear effects of the geometry on the dynamics of walking droplets.

Here we present a simple model inspired from quantum mechanics for the dynamics of a walking droplet in an arbitrary geometry. We propose to describe its trajectory using a Green function approach. The Green function is related to the Helmholtz equation with Neumann boundary conditions on the obstacle(s) and outgoing conditions at infinity.

For a single slit geometry our model is exactly solvable and reproduces some of the features observed experimentally. It stands for a promising candidate to account for the presence of boundaries in the walker's dynamics.