

SCATTERING THEORY OF WALKING DROPLETS IN THE PRESENCE OF OBSTACLES

Rémy Dubertrand, Maxime Hubert, Peter Schlagheck, Nicolas Vandewalle, Thierry Bastin, John Martin¹

¹ : Département de Physique, Université de Liège, Belgium
remy.dubertrand@ulg.ac.be

Abstract: 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 [1], 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 [2, 3].

Here we present a simple model inspired from quantum mechanics for the dynamics of a walking droplet in an arbitrary geometry [4]. 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.

References

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