Walkers in a wave field with memory

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In 2005, Couder *et al.* discovered that droplets bouncing on a vibrated bath mimics a variety of quantum phenomena, as the Faraday wave they generate propels them across the bath [1,2]. Inspired by the experiments that ensued [3,4], and the ever more refined models that represent them [5,6], we propose a continuous model which encapsulates its essential features into a system of three basic differential equations. We find that self-propelled walkers exist in this simple framework, like in the original experiments. When the source particle is much smaller than the Faraday wavelength, we can analytically approach the walker's velocity, and numerically simulate its trajectory in a box of arbitrary shape. The phase lag between the particle's vibration and that of the wave surrounding it proves a prime control on the walker's velocity. More surprisingly, for specific values of this phase, the particle's shape also matters, even when its size vanishes. Finally, making use of the model's familiar formulation, we suggest that a particle coupled with a propagating wave—as opposed to a standing Faraday wave—should behave much like a bouncing droplet.

Références

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