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Capillary surfers at a vibrating fluid interface

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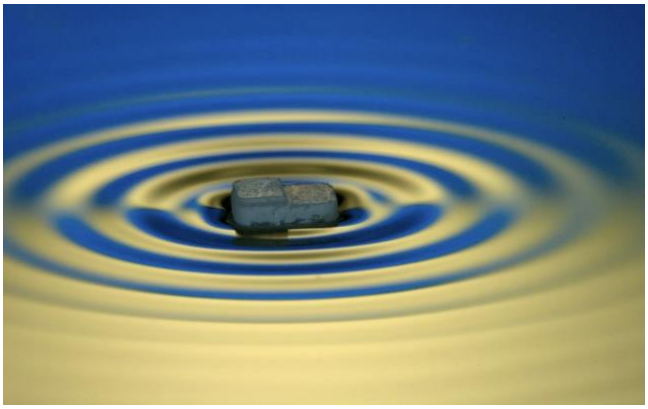
A small solid particle resting atop a vibrating fluid interface generates a field of outwardly propagating capillary waves due to its relative vertical motion. Capillary surfers are wave-driven particles at a fluid interface that we have recently introduced [1] and described theoretically [2].
A capillary surfer is a hydrophobic, millimetric solid particle, the bottom surface of which is pinned to the air-water interface of a vertically vibrating bath. The relative vertical motion of the particle and the interface leads to the generation of propagating capillary waves. When the mass of the particle is unevenly distributed, the particle generates an asymmetric wave field and self-propels along the interface with constant speed on a straight line. The speed and interaction of surfers with their environment can be tuned broadly through the particle, fluid, and vibration parameters. More recently, we have characterized the wave field of capillary surfers and further elucidated the propulsion mechanism. Furthermore, capillary surfers interact with one another through their mutual capillary wavefield and exhibit a set of collective modes characterized by a discrete number of equilibrium spacings for a given set of experimental parameters.



Keywords: capillary waves, fluid interface, self-propulsion.

References

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[2] A. U. Oza, G. Pucci, I. Ho and D. M. Harris, 2023, Theoretical modeling of capillary surfer interactions on a vibrating fluid bath, *Physical Review Fluids*, 8, 114001.

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