Wave field of capillary surfers

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Ho *et al.* [1] have recently introduced capillary surfers: wave-driven particles at a vibrating fluid interface (fig.1(a)). These active particles are characterized by high tunability and have the potential to fill the gap between overdamped and inertial active systems. In addition, they exhibit multistability since their interaction forces are long-range and spatially oscillatory.
Capillary surfers are asymmetric solid objects. It has been suggested that their propulsion is due to asymmetric wave generation on the liquid surface, which would result in an asymmetric transfer of momentum from the surfer to the liquid and net radiation stress [1].

Here we check this propulsion mechanism by measuring the wave field of capillary surfers using a surface reconstruction technique [2,3] (fig.1(b)). Wave field measurements are performed by varying forcing frequency and amplitude and with surfers with different shapes. Indeed, in all cases, the wave field asymmetry is compatible with the direction of the surfer propulsion. A comparison with an existing theoretical model for the surfer wave field is also attempted [4].

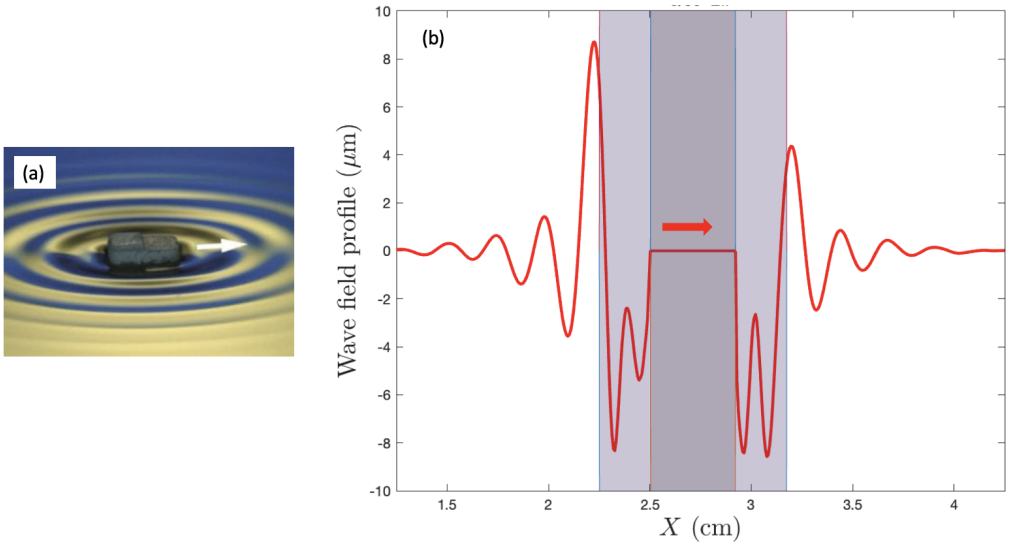

Figure 1. (a) Oblique view of a capillary surfer, from [1]. (b) Profile of the wave field of a capillary surfer along his long axis. The red arrow shows the direction of motion of the surfer. The central shaded zone corresponds to the surfer and the external shaded regions span one capillary length.

References

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2. Moisy, F., Rabaud, M. & Salsac, K. *Exp. Fluids.* **46**, 1021-1036 (2009).
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4. Oza, A., Pucci, G., Ho, I.,& Harris, D. M. *arXiv:2301.05767* (2023).