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Bouncing drops as an example of a particle-wave interaction S. PROTIERE, Y. COUDER, Matiere et Systemes Complexes, UMR 7057 CNRS, Universite Paris 7, ENS, A. BOUDAOUD, Laboratoire de Physique Statistique - ENS Paris — A drop placed at the surface of the same liquid coalesces within a few tenths of seconds. This process can be inhibited by vibrating the bath of liquid on which the drop is placed. The drop will then be able to bounce at the surface of the liquid for an unlimited time (Couder et al PRL 94 177801). Using liquids of low viscosity, a bouncing drop will emit a wave at the surface of the liquid at each bounce. Those drops spontaneously organize themselves in bounded states or in clusters. Just below the Faraday instability threshold, a remarkable phenomenon occurs when the drop undergoes a drift bifurcation and starts moving horizontally at the surface of the liquid, acquiring a constant horizontal velocity. We call such drops walkers. We have studied this transition from a steady bouncing drop to a walker and described it theoretically. A walker never collides directly with one of the cell's walls but, via its own waves and the waves emitted at the boundaries, is repelled and undergoes a reflection. Thus in certain situations the drop can have a billiard-like motion in the cell. We have also observed the various collisions (always via their waves) of several walkers moving across the cell (repulsive or attractive). We will discuss the differences between these new objects and localized structures observed in various 2D dissipative systems such as oscillons in fluids and granular materials or cavity solitons in optics.

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