Quantum-like effects resulting from a wave-mediated memory

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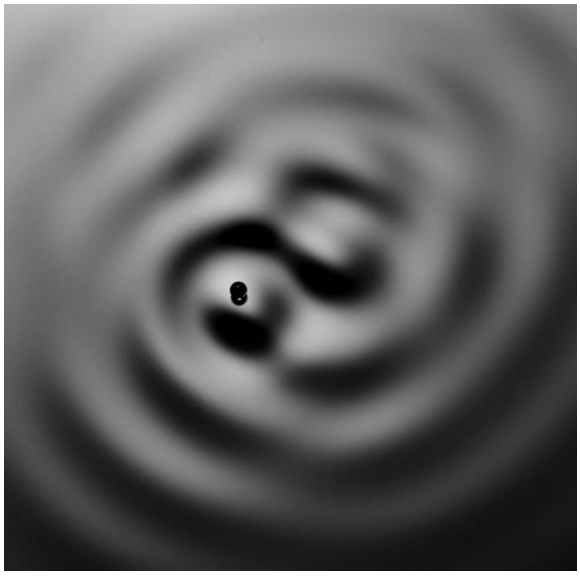
Memory effects are usually thought of as being essential in complex systems, biology or computer science. We will discuss a case where it dominates the dynamics of a simple entity. A droplet bouncing on a vibrated bath can become self-propelled by its coupling to the surface waves it excites. This system is characterized by information interplay. The particle generates the wave and the wave determines where the particle goes. It is not a classical echo-location system because the waves are standing waves. Since they are partly sustained, their interference structure contains a memory of the drop's recent trajectory. In these conditions how can the localized drop have a common dynamics with the extended wave? Surprisingly, experiments as well as numerical simulations reveal that several quantum-like behaviors emerge, all very unusual at classical scale.



An orbiting droplet and its wavefield

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Self-organization into quantized eigenstates of a classical wave-driven particle

S. Perrard, M. Labousse, M. Miskin, E.Fort, & Y. Couder, *Nature Com*, **5**, 3219, (2014)

Wave-based Turing machine: time reversal and information erasing

S. Perrard, E. Fort, Y. Couder, *Phys. Rev. Lett.,* **117**, 094502 (2016)