Abstract Submitted
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A trajectory equation for walking droplets ANAND OZA, RODOLFO ROSALES, JOHN BUSH, Massachusetts Institute of Technology — Yves Couder and coworkers have demonstrated phenomena reminiscent of quantum mechanics in a macroscopic hydrodynamic system. Specifically, they have discovered that millimetric droplets walking on a vibrating fluid bath exhibit wave-particle phenomena previously thought to be peculiar to the microscopic quantum realm, including single-particle diffraction and tunneling. Orbital quantization may be observed by placing a walking drop on a rotating fluid bath, which suggests a correspondence between the drop's quantized orbits and the Landau levels of an electron in a uniform magnetic field. We here develop an integro-differential trajectory equation for these walking droplets with a view to gaining insight into their subtle dynamics. We present an exact formula for the walking speed and compare it to experimental data. We also analyze the stability of the walking solution to infinitesimal perturbations. The trajectory equation is used to model the walking drop in a rotating fluid bath, which allows us to rationalize the observed orbital quantization. We predict the existence of self-orbiting or "spin" states and a mechanism reminiscent of the Zeeman effect in quantum mechanics.

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