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Droplets walking in a rotating frame: from quantized orbits to wavelike statistics[1] DANIEL M. HARRIS, JOHN W.M. BUSH, Massachusetts Institute of Technology — We present the results of an experimental investigation of a droplet walking on the surface of a vibrating rotating fluid bath. Particular attention is given to demonstrating that the stable quantized orbits reported by Fort et al. (PNAS, 2010) arise only for a finite range of vibrational forcing, above which chaotic trajectories with wavelike statistics arise. We first present a detailed characterization of the emergence of orbital quantization, and then examine the system behavior at higher driving amplitudes. As the vibrational forcing is increased progressively, stable circular orbits are succeeded by wobbling orbits with, in turn, stationary and drifting orbital centers. Subsequently, there is a transition to wobble-and-leap dynamics, in which wobbling of increasing amplitude about a stationary center is punctuated by the orbital center leaping approximately half a Faraday wavelength. Finally, in the limit of high vibrational forcing, irregular chaotic trajectories emerge, characterized by a wavelike statistical behavior that reflects the persistent dynamic influence of the unstable orbital states.

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