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Are snakes particles or waves? Scattering of a limbless locomotor through a single slit FEIFEI QIAN, Georgia Institute of Technology, JIN DAI, CHAOHUI GONG, HOWIE CHOSET, Carnegie Mellon University, DANIEL GOLDMAN, Georgia Institute of Technology — Droplets on vertically vibrated fluid surfaces can walk and diffract through a single slit by a pilot wave hydrodynamic interaction [Couder, 2006; Bush, 2015]. Inspired by the correspondence between emergent macroscale dynamics and phenomena in quantum systems, we tested if robotic snakes, which resemble wave packets, behave emergently like particles or waves when interacting with an obstacle. In lab experiments and numerical simulations we measured how a multi-module snake-like robot swam through a single slit. We controlled the snake undulation gait as a fixed serpenoid traveling wave pattern with varying amplitude and initial phase, and we examined the snake trajectory as it swam through a slit with width d. Robot trajectories were straight before interaction with the slit, then exited at different scattering angle θ after the interaction due to a complex interaction of the body wave with the slit. For fixed amplitude and large d, the snake passed through the slit with minimal interaction and *theta* was ≈ 0. For sufficiently small d, θ was finite and bimodally distributed, depending on the initial phase. For intermediate d, θ was sensitive to initial phase, and the width of the distribution of θ increased with decreasing d.

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