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A hydrodynamic analog of Friedel oscillations[1] PEDRO SAENZ, University of North Carolina at Chapel Hill, TUDOR CRISTEA-PLATON, JOHN BUSH, Massachusetts Institute of Technology — Impurities on the surface of a metal may lead to the emergence of wavelike statistical patterns in the surrounding electron sea known as Friedel oscillations. We demonstrate that, despite its vast difference in scale, a classical hydrodynamic pilot-wave system may exhibit strikingly similar statistical behavior. Through experiments and simulations, we study the wave-mediated interaction between a liquid drop self-propelling on the surface of a vibrating fluid bath and a submerged circular well, that plays the role of an impurity, or topological defect, in the medium. The well induces a self-excited attractive force that draws the drop inwards along an Archimedean spiral, before it crosses over the well and departs along a straight radial path. The drop is thus scattered relative to its incoming direction. Oscillations in the drop speed emerge in its outgoing trajectory due to the waves induced by the drop's resonant interaction with the well. By considering an ensemble of particle trajectories, we demonstrate the emergence of localized wavelike statistics in the otherwise uniform histogram of the particle position, an effect strongly reminiscent of Friedel oscillations. The emergent statistical behavior is rationalized in terms of a wave-mediated interaction mechanism.

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