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Quantum Simulation of Oscillatory Unruh Effect with Superposed Trajectories

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A detector moving with relativistic accelerated trajectory would experience Unruh effect and raise both detector excitation and particle creation in the accelerated frame, despite being in a vacuum in the rest frame. We simulate such an effect in the case of the detector oscillating in a cavity with a laser-controlled trapped ion. The simulation could be extended to superposed quantum trajectories, leading to coherent interference of excitation. Our demonstration reveals the Unruh's prediction regarding particle creation by non-inertial motion, as well as the novel coherent effects in quantum field theory relating to quantum gravity.

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