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Quantum flutter versus Bloch oscillations in one-dimensional quantum liquids out of equilibrium CHARLES MATHY, Institute for Theoretical Atomic, Molecular and Optical Physics, MICHAEL KNAP, EUGENE DEMLER, Department of Physics, Harvard University — We study the dynamics of an impurity of finite mass injected into a one-dimensional quantum liquid at zero temperature, either at finite velocity or at zero velocity with a force driving the impurity. We obtain accurate results using numerical simulations based on matrix product states, and find that in both cases, the impurity undergoes oscillations, however the physical mechanism is different: the driven impurity undergoes Bloch oscillations by following the ground state branch through dissipation, while the undriven impurity undergoes coherent quantum oscillations at an emergent energy scale, called quantum flutter in previous work, whose amplitude grows with increasing initial velocity. We find these results to be independent of whether the system is integrable or not, and robust to changes in the microscopics of the model, suggesting that they are universal.

Charles Mathy
Institute for Theoretical Atomic, Molecular and Optical Physics

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