

## **“Punchets” and “inverse ratchets”—surprising applications of nonlinear directed transport**

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“Punchets”, hybrids between ratchets and pumps, generate transport by a local driving, periodic in time, of an otherwise static, spatially periodic potential. They are inspired by metal surfaces irradiated

by a collimated laser beam. Classically, these systems exhibit asymmetric irregular scattering, thus

giving rise to directed currents. They can be quantized in the framework of Floquet scattering, combined with Bloch theory. Pacemakers or “inverse ratchets” are nonlinear systems that generate aperiodic force as output from a constant input force, with a stable frequency over a wide parameter range. An emblematic historical example are the escapements of mechanical clocks. Numerical simulations of a two degrees of freedom model (pendulum and anchor wheel) show that the motion is periodic with constant period over a large range of the input force but becomes chaotic at extreme values.