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Brownian Ratchet Driven by a Rocking Forcing with Broken Temporal Symmetry

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Abstract: The ratchet motion of a Brownian particle in a symmetric periodic potential under a rocking force that breaks the temporal symmetry is studied. As long as the relaxation time in the thermal background is much shorter than the forcing period, the unidirectional transport can be analytically treated. By solving the Fokker-Planck equations, we get an analytical expression of the current. This result indicates that with an appropriate match between the potential field, the asymmetric ac force and the thermal noise, a net current can be achieved. The current versus thermal noise exhibits a stochastic-resonance-like behavior.

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