

Energy Colloquium

Ex(E/O)rcising Demons On The Nanoscale: Brownian Motors, Quantum Machinery And Beyond

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Technopark, Building 3, Room 407



ABSTRACT:

Noise is usually thought of as the enemy of order rather than of a constructive influence. For the phenomena of Brownian motors and quantum machines, however, noise can play a beneficial role in enhancing and facilitating directed transport in absence of biasing forces. We identify variety of intriguing beneficial applications in physical, technological, and biomedical contexts. In their modus operandi such classical and quantum Brownian motors use the energy from the haphazard source of thermal noise in order to perform work against external loads. The basic principles that underpin directed transport in quantum optical and solid-state based devices are elucidated for various nonlinear systems. The very presence of non-equilibrium disturbances enables a quantum Brownian machines to overcome the limiting laws imposed by thermal equilibrium, thereby rectifying quantum Brownian motion for shuttling efficiently quantum objects along *a priori* designed routes. A most recent experimental realization of quantum ratchets with ultracold atoms which validates the theory will be discussed. -- Another timely topic is the manipulation of phonons on the nanoscale for controlling and shuttling heat for analogs of electronic information processing (thermal diodes, thermal transistors and alike).

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