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Title: How hydrodynamic effects and entropic stochastic resonance enhance transport and diffusion of particles in confined media.

Abstract: Hydrodynamic effects and entropic stochastic resonance (ESR) can play an important role in particle transport and diffusion. A space-dependent two-dimensional (2D) diffusion function, D(x,y) [1, 2], which characterizes the local geometrical constraints of the system by quantifying the inner cavity structure is considered. Using this function, the entropic stochastic resonance is computed and visualized, identifying distinct resonance peaks. These peaks correspond to optimal conditions under which the average velocity, mobility, and effective diffusion coefficients are subsequently calculated and analyzed. A notable difference between transport properties computed with and without the inclusion of the local diffusion function D(x,y) is highlighted. Thus, revealing the influence of spatial inhomogeneities in modulating particle dynamics. Furthermore, emphasize the influence of ESR peak values by evaluating mobility and diffusion for parameter regimes both above and below the resonance peak. The configurations involving simple potentials and deformable channels are compared with other works [3, 4]. That to ascertain which arrangement most efficiently facilitates transport, especially when enhanced by the combined contributions of hydrodynamic effects and entropic stochastic resonance. The findings provide insights into transport optimization in complex environments, with implications for designing efficient micro- and nanoscale devices.

References

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