

World Year of Physics 2005: focus on Brownian motion and diffusion in the 21st century [Edited Collection Abstract]

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Focus on Brownian Motion and Diffusion in the 21st Century

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Abstract

Without doubt, the problem of Brownian motion has played a guiding role in the development for both the foundations of thermodynamics and the dynamical aspects of statistical physics. The development of the phenomenon of Brownian motion based on the molecular-kinetic theory of heat provides a link between the microscopic dynamics and the macroscopic phenomena such as diffusion and fluctuation phenomena. It has also provided a first link between the macroscopic response and the equilibrium fluctuation characteristics via an early form of the ubiquitous fluctuation-dissipation theorem: the Einstein relation that relates the mobility to the diffusion strength.

The topic of Brownian motion has likewise inspired many scientists to deploy a consistent treatment of phenomena far from thermal equilibrium via such concepts as the Fokker–Planck or master equation descriptions of noisy nonlinear dynamics in such diverse areas as soft matter physics, surface science, solid state physics and chemical kinetics. In recent years this theme has also increasingly impacted upon the life sciences and even extends to areas such as cosmology, astrophysics and econophysics.

This celebratory Focus Issue in *New Journal of Physics* is not only timely but also circumstantiates that this research topic is very much alive and indeed multifaceted. As Guest Editors we share the confident belief that the contributions by leading practitioners from a diverse range of backgrounds will together provide a fair and accurate snapshot of the current state of this rich and interdisciplinary research field. Last but not least, we hope that this issue will stimulate readers into pursuing research of their own in the exciting areas represented.

Focus on Brownian Motion and Diffusion in the 21st Century Contents

[Stochastic resonance in the presence of slowly varying control parameters](#) *C Nicolis and G Nicolis*

[Diffusion processes and memory effects](#) *Anatolii V Mokshin, Renat M Yulmetyev and Peter Hänggi*

[From Maxwell demon to Brownian motor](#) *C Van den Broeck, P Meurs and R Kawai*

[On the connection between biased dichotomous diffusion and the one-dimensional Dirac equation](#) *V Balakrishnan and S Lakshmibala*

[Branching of nucleation paths in a metastable lattice gas with Metropolis dynamics](#) *Vitaly A Shneidman*

[Does one-dimensional \(1D\) adatom and cluster diffusion of Pt on the Pt\(110\)-\(1 × 2\) surface lead to 1D ripening?](#) *T R Linderoth, S Horch, L Petersen, E Lægsgaard, I Stensgaard and F Besenbacher*

[Statistics of transition times, phase diffusion and synchronization in periodically driven bistable systems](#) *Peter Talkner, Lukasz Machura, Michael Schindler, Peter Hänggi and Jerzy Luczka*

[Molecular dynamics under confinement to one dimension: options of measurement and accessible information](#) *Jörg Kärger, Rustem Valiullin and Sergey Vasenkov*

[Bulk-mediated surface diffusion: non-Markovian desorption dynamics](#) *Jorge A Revelli, Carlos E Budde, Domingo Prato and Horacio S Wio*

[Thermal activation by power-limited coloured noise](#) *Peter Jung, Alexander Neiman, Muhammad K N Afghan, Suhita Nadkarni and Ghanim Ullah*

[Noise-sustained and controlled synchronization of stirred excitable media by external forcing](#) *Changsong Zhou and Jürgen Kurths*

[Jump rate and jump probabilities in the two-dimensional strong-collision model](#) *R Ferrando, M Mazroui, R Spadacini and G E Tommei*

[Brownian motion in a granular fluid](#) *James W Dufty and J Javier Brey*

[Kinetics of subdiffusion-assisted reactions: non-Markovian stochastic Liouville equation approach](#) *A I Shushin*

[Continuum limit theory of absorption in the presence of dissipation](#) *Reuven Iancu, Mikhail G Brik and Eli Pollak*

[Tracking of single molecules as a powerful method to characterize diffusivity of organic species in mesoporous materials](#) *Christian Hellriegel, Johanna Kirstein and Christoph Bräuchle*

[A model for noise effects on fibre tract trajectories in diffusion tensor imaging: theory and simulations](#) *Marián Boguñá, Sinisa Pajevic, Peter J Basser and George H Weiss*

[Description of atomic friction as forced Brownian motion](#) *Peter Reimann and Mykhaylo Evstigneev*

[What is special about diffusion on scale-free nets?](#) *Erik M Bollt and Daniel ben-Avraham*

[Time-dependent friction and solvation time correlation function](#) *Alok Samanta, Sk Musharaf Ali and Swapan K Ghosh*

[Observing Brownian motion and measuring temperatures in vibration-fluidized granular matter](#) *Patrick Mayor, Gianfranco D'Anna, Alain Barrat and Vittorio Loreto*

[Transport and diffusion on crystalline surfaces under external forces](#) *Katja Lindenberg, A M Lacasta, J M Sancho and A H Romero*

[Disordered iterated maps: spectral properties, escape rates and anomalous transport](#) *Andreas Fichtner and Günter Radons*

[Exact substitute processes for diffusion–reaction systems with local complete exclusion rules](#) *Michael Schulz and Peter Reineker*

[Lyapunov modes in soft-disk fluids](#) *Christina Forster and Harald A Posch*

[Video microscopy and micromechanics studies of one- and two-dimensional colloidal crystals](#) *Alexandros Pertsinidis and Xinsheng Sean Ling*

[Position-dependent diffusion coefficients and free energies from Bayesian analysis of equilibrium and replica molecular dynamics simulations](#) *Gerhard Hummer*

[Mesoscopic thermodynamics of stationary non-equilibrium states](#) *I Santamaría-Holek, J M Rubí and A Pérez-Madrid*

[Population explosion suppressed by noise: stationary distributions and how to simulate them](#) *P F Góra*

[The colour of thermal noise in classical Brownian motion: a feasibility study of direct experimental observation](#) *Kirstine Berg-Sørensen and Henrik Flyvbjerg*

[On diffusion of large matrices](#) *Ewa Gudowska-Nowak, Romuald A Janik, Jerzy Jurkiewicz and Maciej A Nowak*

[Mixing and spectral-correlation properties of chaotic and stochastic systems: numerical and physical experiments](#) *V S Anishchenko, G A Okrovertskhov, T E Vadivasova and G I Strelkova*

[Brownian motion, dynamical randomness and irreversibility](#) *Pierre Gaspard*

[Experimentally realizable devices for domain wall motion control](#) *Sergey Savel'ev, Alexander Rakhmanov and Franco Nori*

[Stochastic pure states for quantum Brownian motion](#) *Walter T Strunz*

[Transport properties of nanopores in electrolyte solutions: the diffusional model and surface currents](#) *A Fulinski, I Kosinska and Z Siwy*

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