Brownian Ratchets From Statistical Physics To Bio And Nano Motors

Elements of Statistical MechanicsStatistical Mechanics in Physics and Biology: Volume 463Stochastic Processes in Cell BiologyStatistical Physics for Biological MatterChemical AbstractsProtein CondensationBiological PhysicsIndian Science AbstractsPhysical ReviewCytoskeletal MechanicsNoiseActa Physica PolonicaMathematical ReviewsEesti Teaduste Akadeemia ToimetisedInternational Conference on Theoretical PhysicsJournal of the Indian Institute of ScienceNoise Sustained PatternsLectures On ComputationNonequilibrium Statistical Mechanics in One DimensionNonequilibrium Statistical Physics of Small SystemsProgress in Statistical and Nonlinear PhysicsBrownian RatchetsIntroduction to the Foundations of Applied MathematicsAn Introduction to Stochastic Processes and Nonequilibrium Statistical PhysicsStatistical Mechanics of Threshold Activated Systems, Chennai, India, 24-26 March, 2003Noise in Complex Systems and Stochastic DynamicsStatistical Mechanics of BiocomplexityThermodynamics and Statistical Mechanics of Small SystemsPhilosophy of Thermal and Statistical PhysicsEnergy and EntropyMathematical Models of Protein Mediated Cell MovementsCounterion Condensation's Effect on SSDNA Translocation Throughs a NanoporeNoise and FluctuationsPhysics of LifeLife's RatchetSlow Dynamics in Complex SystemsProceedingsStochastic

Processes in Physics, Chemistry, and BiologyAdvances in Condensed Matter and Statistical PhysicsPhysics letters : [part A].

Elements of Statistical Mechanics

This 2006 textbook provides a concise introduction to the key concepts and tools of statistical mechanics. It also covers advanced topics such as non-relativistic quantum field theory and numerical methods. After introducing classical analytical techniques, such as cluster expansion and Landau theory, the authors present important numerical methods with applications to magnetic systems, Lennard-Jones fluids and biophysics. Quantum statistical mechanics is discussed in detail and applied to Bose-Einstein condensation and topics in astrophysics and cosmology. In order to describe emergent phenomena in interacting quantum systems, canonical non-relativistic quantum field theory is introduced and then reformulated in terms of Feynman integrals. Combining the authors' many years' experience of teaching courses in this area, this textbook is ideal for advanced undergraduate and graduate students in physics, chemistry and mathematics.

Statistical Mechanics in Physics and Biology: Volume 463

Covering the theory of computation, information and communications, the physical aspects of computation, and the physical limits of computers, this text is

based on the notes taken by one of its editors, Tony Hey, on a lecture course on computation given b

Stochastic Processes in Cell Biology

Statistical Physics for Biological Matter

This book presents a full spectrum of views on current approaches to modeling cell mechanics. The authors come from the biophysics, bioengineering and physical chemistry communities and each joins the discussion with a unique perspective on biological systems. Consequently, the approaches range from finite element methods commonly used in continuum mechanics to models of the cytoskeleton as a cross-linked polymer network to models of glassy materials and gels. Studies reflect both the static, instantaneous nature of the structure, as well as its dynamic nature due to polymerization and the full array of biological processes. While it is unlikely that a single unifying approach will evolve from this diversity, it is the hope that a better appreciation of the various perspectives will lead to a highly coordinated approach to exploring the essential problems and better discussions among investigators with differing views.

Chemical Abstracts

Protein Condensation

FOAM. This acronym has been used for over ?fty years at Rensselaer to designate an upper-division course entitled, Foundations of Applied Ma- ematics. This course was started by George Handelman in 1956, when he came to Rensselaer from the Carnegie Institute of Technology. His objective was to closely integrate mathematical and physical reasoning, and in the p- cess enable students to obtain a qualitative understanding of the world we live in. FOAM was soon taken over by a young faculty member, Lee Segel. About this time a similar course, Introduction to Applied Mathematics, was introduced by Chia-Ch'iao Lin at the Massachusetts Institute of Technology. Together Lin and Segel, with help from Handelman, produced one of the landmark textbooks in applied mathematics, Mathematics Applied to - terministic Problems in the Natural Sciences. This was originally published in 1974, and republished in 1988 by the Society for Industrial and Applied Mathematics, in their Classics Series. This textbook comes from the author teaching FOAM over the last few years. In this sense, it is an updated version of the Lin and Segel textbook.

Biological Physics

Please note that the content of this book primarily consists of articles available from Wikipedia or other free sources online. Pages: 42. Chapters: Arrow of time, Boltzmann brain, Brownian ratchet, Configuration entropy, Entropy in thermodynamics and information theory, Ergodic hypothesis, H-theorem, Kelvin-Planck statement, Landauer's

principle, Loschmidt's paradox, Maximum entropy thermodynamics, Maxwell's demon, Molecular chaos, Second law of thermodynamics, Statistical ensemble (mathematical physics), T-symmetry. Excerpt: Entropy in statistical mechanics is a measure of the number of specific ways in which a system may be arranged, often taken to be a measure of "disorder"; the higher the entropy, the higher the disorder. The entropy of an isolated system never decreases, because isolated systems spontaneously evolve towards thermodynamic equilibrium - the state of maximum entropy. (see Second law of thermodynamics) Entropy is a mathematically-defined thermodynamic quantity that helps to account for the flow of energy through a thermodynamic process. Entropy was originally defined for a thermodynamically reversible process as where the uniform temperature () of a closed system is divided into an incremental reversible transfer of heat energy into that system (). The above definition is sometimes called the macroscopic definition of entropy because it can be used without regard to any microscopic picture of the contents of a system. In thermodynamics, entropy has been found to be more generally useful and it has several other reformulations. Entropy was discovered when it was noticed via mathematics to be a quantity that behaves as a function of state. Entropy is an extensive property, but it is often given as an intensive property of specific entropy as entropy per unit mass or entropy per mole. In statistical mechanics, entropy is often related to the notions of order and disorder. In the modern microscopic interpretation of entropy in statistical

Indian Science Abstracts

This book offers a comprehensive picture of nonequilibrium phenomena in nanoscale systems. Written by internationally recognized experts in the field, this book strikes a balance between theory and experiment, and includes in-depth introductions to nonequilibrium fluctuation relations, nonlinear dynamics and transport, single molecule experiments, and molecular diffusion in nanopores. The authors explore the application of these concepts to nano- and biosystems by cross-linking key methods and ideas from nonequilibrium statistical physics, thermodynamics, stochastic theory, and dynamical systems. By providing an up-to-date survey of small systems physics, the text serves as both a valuable reference for experienced researchers and as an ideal starting point for graduate-level students entering this newly emerging research field.

Physical Review

Proceedings of SPIE present the original research papers presented at SPIE conferences and other high-quality conferences in the broad-ranging fields of optics and photonics. These books provide prompt access to the latest innovations in research and technology in their respective fields. Proceedings of SPIE are among the most cited references in patent literature.

Cytoskeletal Mechanics

Energy is typically regarded as understandable, despite its multiple forms of storage and transfer. Entropy, however, is an enigma, in part because of the common view that it represents disorder. That view is flawed and hides entropy's connection with energy. In fact, macroscopic matter stores internal energy, and that matter's entropy is determined by how the energy is stored. Energy and entropy are intimately linked. Energy and Entropy: A Dynamic Duo illuminates connections between energy and entropy for students, teachers, and researchers. Conceptual understanding is emphasised where possible through examples, analogies, figures, and key points. Features: Qualitative demonstration that entropy is linked to spatial and temporal energy spreading, with equilibrium corresponding to the most equitable distribution of energy, which corresponds to maximum entropy Analysis of energy and entropy of matter and photons, with examples ranging from rubber bands, cryogenic cooling, and incandescent lamps to Hawking radiation of black holes Unique coverage of numerical entropy, the 3rd law of thermodynamics, entropic force, dimensionless entropy, free energy, and fluctuations, from Maxwell's demon to Brownian ratchets, plus attempts to violate the second law of thermodynamics

Noise

This book demonstrates the usefulness of tools from statistical mechanics for biology. It includes the new tendencies in topics like membranes, vesicles, microtubules, molecular motors, DNA, protein folding,

phase transitions in biological systems, evolution, population dynamics, neural systems and biological oscillators, with special emphasis on the importance of statistical mechanics in their development. The book addresses researchers and graduate students.

Acta Physica Polonica

Illustrating the development of Brownian ratchets, from their foundations, to their role in the description of life at the molecular scale and in the design of artificial nano-machinery, this text will appeal to both advanced graduates and researchers entering the field. Providing a self-contained introduction to Brownian ratchets, devices which rectify microscopic fluctuations, Part I avoids technicalities and sets out the broad range of physical systems where the concept of ratchets is relevant. Part II supplies a single source for a complete and modern theoretical analysis of ratchets in regimes such as classical vs quantum and stochastic vs deterministic, and in Part III readers are guided through experimental developments in different physical systems, each highlighting a specific unique feature of ratchets. The thorough and systematic approach to the topic ensures that this book provides a complete guide to Brownian ratchets for newcomers and established researchers in physics, biology and biochemistry.

Mathematical Reviews

Theoretical physics is a vast set of subjects, ideas and methods, with wide and unexpected applications to

many interdisciplinary problems. But no general international conference had tried to review in depth this huge and burgeoning field since the Trieste conference in 1968. The International Conference on Theoretical Physics, TH-2002, which took place at the Unesco building, Paris, from July 22 to 27, 2002, addressed this challenge.The reader will find in this book all invited and received contributions to the conference. After the general lectures of Nobel prize winners Anderson and Yang, the contributions by experts cover all aspects of modern theoretical physics ranging from particle physics, string theory, cosmology, statistical and condensed matter physics to dynamical systems and quantum chaos, the physics/biology interface, information theory and quantum computing.

Eesti Teaduste Akadeemia Toimetised

This book gives up-to-date information on the liquid-glass transition in various disciplines, such as physics, chemistry, biology, engineering, polymer science, and computer science. The book contains review articles by leading scientists and contributed papers by authors in the forefront of research. The systems studied covered almost all states of matter including solids, liquids, complex solutions, polymers, and suspensions. Significant progress was made on a variety of topics. Among these were experimental and theoretical studies of colloidal systems; experiments on glass to glass transitions in micellar systems; theoretical studies of polyelectrolytes and polymer melts and networks; theoretical and computer studies

of hydrodynamics in suspensions and Rayleigh-Taylor and Rayleigh-Couette instabilities; theoretical and experimental studies of the glass transition; computer simulations of the glass transition in thin films; vibrational motions in glass forming liquids and glasses; the effects of shear on supercooled liquids; engineering and experimental studies of metallic glasses; mode-coupling studies of complex glass formation; and Lorentz gas studies of the translational and rotational motion of a rigid rod.

International Conference on Theoretical Physics

All papers were peer-reviewed. ICNF covers a wide variety of topics on noise and fluctuations. Research activity on noise involves several quite different disciplines (physics, engineering, mathematics, biology, chemistry, signal theory, etc.) and requires both fundamental and technological scientific efforts. Advanced micro- and nanoelectronic devices and related circuites and applications, where noise constitutes a key performance limitation, is one of the fundamental interests.

Journal of the Indian Institute of Science

This book aims to cover a broad range of topics in statistical physics, including statistical mechanics (equilibrium and non-equilibrium), soft matter and fluid physics, for applications to biological phenomena at both cellular and macromolecular levels. It is intended to be a graduate level textbook, but can also

be addressed to the interested senior level undergraduate. The book is written also for those involved in research on biological systems or soft matter based on physics, particularly on statistical physics. Typical statistical physics courses cover ideal gases (classical and quantum) and interacting units of simple structures. In contrast, even simple biological fluids are solutions of macromolecules, the structures of which are very complex. The goal of this book to fill this wide gap by providing appropriate content as well as by explaining the theoretical method that typifies good modeling, namely, the method of coarse-grained descriptions that extract the most salient features emerging at mesoscopic scales. The major topics covered in this book include thermodynamics, equilibrium statistical mechanics, soft matter physics of polymers and membranes, non-equilibrium statistical physics covering stochastic processes, transport phenomena and hydrodynamics. Generic methods and theories are described with detailed derivations, followed by applications and examples in biology. The book aims to help the readers build, systematically and coherently through basic principles, their own understanding of nonspecific concepts and theoretical methods, which they may be able to apply to a broader class of biological problems.

Noise Sustained Patterns

Lectures On Computation

This book is a printed edition of the Special Issue "Thermodynamics and Statistical Mechanics of Small Systems" that was published in Entropy

Nonequilibrium Statistical Mechanics in One Dimension

The theory of stochastic processes originally grew out of efforts to describe Brownian motion quantitatively. Today it provides a huge arsenal of methods suitable for analyzing the influence of noise on a wide range of systems. The credit for acquiring all the deep insights and powerful methods is due ma- ly to a handful of physicists and mathematicians: Einstein, Smoluchowski, Langevin, Wiener, Stratonovich, etc. Hence it is no surprise that until - cently the bulk of basic and applied stochastic research was devoted to purely mathematical and physical questions. However, in the last decade we have witnessed an enormous growth of results achieved in other sciences - especially chemistry and biology - based on applying methods of stochastic processes. One reason for this stochastics boom may be that the realization that noise plays a constructive rather than the expected deteriorating role has spread to communities beyond physics. Besides their aesthetic appeal these noise-induced, noise-supported or noise-enhanced effects sometimes offer an explanation for so far open pr- lems (information transmission in the nervous system and information p- cessing in the brain, processes at the cell level, enzymatic reactions, etc.). They may also pave the way to novel technological applications (noise-- hanced reaction

rates, noise-induced transport and separation on the na- scale, etc.). Key words to be mentioned in this context are stochastic r- onance, Brownian motors or ratchets, and noise-supported phenomena in excitable systems.

Nonequilibrium Statistical Physics of Small Systems

Progress in Statistical and Nonlinear Physics

The purpose of this textbook is to bring together, in a self-contained introductory form, the scattered material in the field of stochastic processes and statistical physics. It offers the opportunity of being acquainted with stochastic, kinetic and nonequilibrium processes. Although the research techniques in these areas have become standard procedures, they are not usually taught in the normal courses on statistical physics. For students of physics in their last year and graduate students who wish to gain an invaluable introduction on the above subjects, this book is a necessary tool. Contents:Stochastic Processes and the Master Equation:Stochastic ProcessesMarkovian ProcessesMaster EquationsKramers Moyal ExpansionBrownian Motion, Langevin and Fokker-Planck EquationsDistributions, BBGKY Hierarchy, Density Operator:Probability Density as a FluidBBGKY HierarchyMicroscopic Balance EquationsDensity OperatorLinear Nonequilibrium Thermodynamics and Onsager

Relations:Onsager Regression to Equilibrium HypothesisOnsager RelationsMinimum Production of EntropyLinear Response Theory, Fluctuation-Dissipation Theorem:Correlation Functions: Definitions and PropertiesLinear Response TheoryFluctuation-Dissipation TheoremInstabilities and Far from Equilibrium Phase-Transitions:Limit Cycles, Bifurcations, Symmetry BreakingNoise Induced TransitionsFormation and Propagation of Patterns in Far from Equilibrium Systems:Reaction-Diffusion Descriptions and Pattern FormationPattern Propagation Readership: Graduate students in physics and chemistry. keywords:Stochastic Processes;Langevin and Fokker-Planck Equations;Statistical Physics;Onsager Relations;Linear Response;Nonequilibrium Statistical Physics;Transport Processes;Noise Induced Transitions;Instabilities;Pattern Formation and Propagation “This book introduces ways to investigate nonequilibrium statistical physics, mainly via stochastic processes, and presents results achieved with such methodology … it is suitable for seminars directed towards relatively mature students in theoretical physics or applied mathematics.” H Muthsam “The present book is a good choice for a single book covering the field … suitable for undergraduate students in the last year and graduate students. They will find in it a suggestive introduction that motivates them to dig deeper into the field and to look for those topics omitted from the text … highly recommended to anyone interested in becoming acquainted with nonequilibrium statistical physics.” Journal of Statistical Physics

Brownian Ratchets

Introduction to the Foundations of Applied Mathematics

The purpose of the book is to give a survey of the physics that is relevant for biological applications, and also to discuss what kind of biology needs physics. The book gives a broad account of basic physics, relevant for the applications and various applications from properties of proteins to processes in the cell to wider themes such as the brain, the origin of life and evolution. It also considers general questions of common interest such as reductionism, determinism and randomness, where the physics view often is misunderstood. The subtle balance between order and disorder is a repeated theme appearing in many contexts. There are descriptive parts which shall be sufficient for the comprehension of general ideas, and more detailed, formalistic parts for those who want to go deeper, and see the ideas expressed in terms of mathematical formulas. - Describes how physics is needed for understanding basic principles of biology - Discusses the delicate balance between order and disorder in living systems - Explores how physics play a role high biological functions, such as learning and thinking

An Introduction to Stochastic Processes and Nonequilibrium Statistical Physics

The MRS Symposium Proceeding series is an

internationally recognised reference suitable for researchers and practitioners.

Statistical Mechanics of Threshold Activated Systems, Chennai, India, 24-26 March, 2003

Noise in Complex Systems and Stochastic Dynamics

Statistical Mechanics of Biocomplexity

Thermodynamics and Statistical Mechanics of Small Systems

Philosophy of Thermal and Statistical Physics

Self-contained and up-to-date guide to one-dimensional reactions, dynamics, diffusion and adsorption.

Energy and Entropy

Mathematical Models of Protein Mediated Cell Movements

Ch. 1. Introduction. 1.1. Stability theory revisited. 1.2. Instabilities and nonlinear events in everyday life. 1.3 Postscript -- ch. 2. Essentials. 2.1. Probabilistic and information theoretic measures. 2.2. Matrix manipulations. 2.3. Delay-differential equations. 2.4. The fluctuation-dissipation theorem. 2.5. The Fokker-Planck equation. 2.6. Numerical techniques for the simulation of stochastic equations. 2.7. Experimental aspects of generating noise. 2.8. Complex integration -- ch. 3. Noise induced temporal phenomena. 3.1. Escape from metastable states. 3.2. Stochastic resonance in bistable systems. 3.3. Postscript -- ch. 4. Adding spatial dimensions. 4.1. Spatiotemporal stochastic resonance. 4.2. Doubly stochastic resonance. 4.3. Spatial patterns. 4.4. Postscript -- ch. 5. Stochastic transport phenomena. 5.1. Noise-sustained structures in convectively unstable media. 5.2. Noise sustained front transmission. 5.3. Theory. 5.4. Noise enhanced wave propagation. 5.5. Stochastic ratchets and Brownian motors. 5.6. Postscript -- ch. 6. Sundry topics. 6.1. Minority game. 6.2. Traffic dynamics. 6.3. Dithering. 6.4. Noise in neural networks -- ch. 7. Afterthoughts

Counterion Condensation's Effect on SSDNA Translocation Throughs a Nanopore

The book contains articles from leading experts in different areas of biological physics. Topics ranging from cell dynamics to the evolution of multicellularity to conscious versus non-conscious evidence accumulation are reviewed and discussed, both from

a theoretical and an experimental perspective. Furthermore, current developments of practical applications like magnetic tweezers for the study of DNA replication and brain imaging are presented.

Noise and Fluctuations

A physicist describes how life emerges from the random motion of atoms through sophisticated cellular machinery and describes the long quest to determine the true nature of life from ancient Greece to the study of modern nanotechnology. 20,000 first printing.

Physics of Life

Life's Ratchet

This book develops the theory of continuous and discrete stochastic processes within the context of cell biology. A wide range of biological topics are covered including normal and anomalous diffusion in complex cellular environments, stochastic ion channels and excitable systems, stochastic calcium signaling, molecular motors, intracellular transport, signal transduction, bacterial chemotaxis, robustness in gene networks, genetic switches and oscillators, cell polarization, polymerization, cellular length control, and branching processes. The book also provides a pedagogical introduction to the theory of stochastic process – Fokker Planck equations, stochastic differential equations, master equations

and jump Markov processes, diffusion approximations and the system size expansion, first passage time problems, stochastic hybrid systems, reaction-diffusion equations, exclusion processes, WKB methods, martingales and branching processes, stochastic calculus, and numerical methods. This text is primarily aimed at graduate students and researchers working in mathematical biology and applied mathematicians interested in stochastic modeling. Applied probabilists and theoretical physicists should also find it of interest. It assumes no prior background in statistical physics and introduces concepts in stochastic processes via motivating biological applications. The book is highly illustrated and contains a large number of examples and exercises that further develop the models and ideas in the body of the text. It is based on a course that the author has taught at the University of Utah for many years.

Slow Dynamics in Complex Systems

The science commentator author of the best-selling Fuzzy Thinking presents a scientific history of noise for general readers, defining noise as an unaesthetic signal that occurs at every level of the universe that has made significant contributions in each period from the ice age to the information age. 20,000 first printing.

Proceedings

Stochastic Processes in Physics, Chemistry, and Biology

In this book, the authors present a number of review articles on topics from various subfields of condensed matter and statistical mechanics which have been recently, or currently are, the focus of intense activity, most of which have cross-disciplinary implications to other domains of science. The chapters are divided into three large classes of studies, namely: (i) systems whose evolutions are dominated by, or are essentially the effect of, fluctuations; (ii) driven systems in which the way to dissipate driving forces is relevant; (iii) systems in which disorder in the interactions induce highly non-trivial dynamics leading naturally to questions of (computational) complexity.

Advances in Condensed Matter and Statistical Physics

The quest to understand the condensation of proteins from solutions is a rapidly evolving field. The purpose of this book is to bring to an interdisciplinary audience the state-of-the-art in current research. The first part of the book deals with issues related to the production of high quality protein crystals from solution. Since protein function is determined by structure, high quality protein crystals must be grown in order to determine their structure by X-ray crystallography. The book also discusses diseases that occur due to undesired protein condensation, an increasingly important subject. Examples include sickle cell

anemia, cataracts and Alzheimer's disease. Current experimental and theoretical work on these diseases is discussed, which seeks understanding at a fundamental, molecular level, to prevent the undesired condensation from occurring. The book, containing color plate sections, is suitable for graduate students and academic researchers in physics, chemistry, structural biology, protein crystallography and medicine.

Physics letters : [part A].