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Spectroscopy and Molecular Dynamics in Nonpolar Fluids Springer Science & Business Media
There are only few discoveries and new technologies in physical sciences that have the potential to dramatically alter and revolutionize our electronic world. Topological insulators are one of them. The present book for the first time provides a full overview and in-depth knowledge about this hot topic in materials science and condensed matter physics. Techniques such as angle-resolved photoemission spectrometry (ARPES), advanced solid-state Nuclear Magnetic Resonance (NMR) or scanning-tunnel microscopy (STM) together with key principles of topological insulators such as spin-locked electronic states, the Dirac point, quantum Hall effects and Majorana fermions are illuminated in individual chapters and are described in a clear and logical form. Written by an international team of experts, many of them directly involved in the very first discovery of topological insulators, the book provides the readers with the knowledge they need to understand the electronic behavior of these unique materials. Being more than a reference work, this book is essential for newcomers and advanced researchers working in the field of topological insulators.
Energy Storage and Redistribution in Molecules Springer Science & Business Media
Carbon based pi-conjugated materials offer a broad range of applications, going from molecular electronics and single molecule devices to nanotechnology, plastic electronics and optoelectronics. The proper physical description of such materials is in between that of molecular solids and that of low-dimensional covalent semiconductors. This book is a comprehensive review of their elementary excitations processes and dynamics, which merges the two viewpoints, sometimes very different if not contrasting. In each chapter, a broad tutorial introduction provides a solid physical background to the topic, which is further discussed based on recent experimental results obtained via state-of-the-art techniques. Both the molecular, intra-chain character and the solid state, inter-molecular physics is addressed. Reports on single molecule and single polymer chain spectroscopy introduce the on-site phenomena. Several chapters are dedicated to nano-probes, steady state and transient spectroscopies.

The highly ordered state, occurring in single crystals, is also discussed thoroughly. Finally, less conventional tools such as THz spectroscopy are discussed in detail. The book provides a useful introduction to the field for newcomers, and a valid reference for experienced researchers in the field.

NASA Thesaurus Alphabetical Update Springer

This book presents an in-depth systematic investigation of a dissipative effect which manifests itself as the growth of hydrodynamic stability and suppression of turbulence in relaxing molecular gas flows. The work describes the theoretical foundations of a new way to control stability and laminar turbulent transitions in aerodynamic flows. It develops hydrodynamic models for describing thermal nonequilibrium gas flows which allow the consideration of suppression of inviscid acoustic waves in 2D shear flows. Then, nonlinear evolution of large-scale vortices and Kelvin-Helmholtz waves in relaxing shear flows are studied. Critical Reynolds numbers in supersonic Couette flows are calculated analytically and numerically within the framework of both linear and nonlinear classical energy hydrodynamic stability theories. The calculations clearly show that the relaxation process can appreciably delay the laminar-turbulent transition. The aim of the book is to show the new dissipative effect, which can be used for flow control and laminarization. This volume will be of interest and useful to mechanical engineers, physicists, and mathematicians who specialize in hydrodynamic stability theory, turbulence, and laminarization of flows.

Molecular Excitation Dynamics and Relaxation Elsevier

Primary events in natural systems or devices occur on extremely short time scales, and yet determine in many cases the final performance or output. For this reason research in ultrafast science is of primary importance and impact in both fundamental research as well as its applications. This book reviews the advances in the field, addressing timely and open questions such as the role of quantum coherence in biology, the role of excess energy in electron injection at photovoltaic interfaces or the dynamics in quantum confined structures (e.g. multi carrier generation). The approach is that of a monograph, with a broad tutorial introduction and an overview of the recent results. This volume includes selected lectures presented at Symposium on Ultrafast Dynamics of the 7th International Conference on Materials for Advanced Technologies. Contents:Femtosecond Real-Time Vibrational Spectroscopy Using Ultrafast Laser Pulses (Takayoshi Kobayashi and Juan Du)Multidimensional Optical Spectroscopy Using a Pump-Probe Configuration: Some Implementation Details (Zhengyang Zhang and Howe-Siang Tan)High-Sensitivity Ultrafast Transient Absorption Spectroscopy of Organic Photovoltaic Devices (Alex J Barker, Kai Chen, Shyamal Prasad and Justin M Hodgkiss)Transient Absorption Data Analysis by Soft-Modelling (I A Howard, H Mangold, F Etzold, D Gehrig and F Laquai)Infrared Ultrafast Optical Probes of Photoexcitations in Π-Conjugated Polymers/Fullerene Blends for Photovoltaic Applications (C-X Sheng, U Huynh and Z V Vardeny)Ultrafast Optical Probing of Carrier Motion in Conjugated Polymers and Blends for Solar Cells (Vidmantas Gulbinas, Andrius Devizis, Domantas Peckus and Dirk Hertel)Singlet Fission in Organic Crystals (Lin Ma, Christian Kloc, Cesare Soci, Maria E Michel-Beyerle and Gagik G Gurzadyan)Mapping Carrier Diffusion in Single Silicon Core-Shell Nanowires with Ultrafast Optical Microscopy (Minah Seo, Jinkyoung Yoo, Shadi Dayeh, Julio Martinez, Brian Swartzentruber, Samuel Picraux, Antoinette Taylor and Rohit Prasankumar)Exciton Dynamics and Its Regulation Ability in Photosynthesis (V Balevicius, Jr, L Valkunas and D Abramavicius)Ultrafast Intramolecular Dynamics in Novel Star-Shaped Molecules for Photovoltaic Applications (Oleg V Kozlov, Yuriy N Luponosov, Sergei A Ponomarenko, Dmitry Yu Paraschuk, Nina Kausch-Busies and Maxim S Pshenichnikov)Nonlinear Spectroscopy of Interfaces and Its Application to Organic Electronics (Silvia G Motti, Francisco C B Maia and Paulo B Miranda)Photoinduced Charge Transfer Dynamics at HybridGaAs/P3HT Interfaces (Jun Yin, Manoj Kumar, Majid Panahandeh-Fard, Zilong Wang, Francesco Scotognella and Cesare Soci)The First Step in Vision: Visualizing Wavepacket Motion through a Conical Intersection (Dario Polli, Daniele Brida, Cristian Manzoni, Giulio Cerullo, Piero Altoe', Marco Garavelli, Oliver Weingart, Katelyn Spillane, Philipp Kukura and Richard A Mathies)Ultrafast Investigation of Energy and Charge Transfer in a Prototypical Photovoltaic Blend (Guglielmo Lanzani, Ajay Ram Srimath Kandada and Daniele Fazzi)Vacancy-Doped Plasmonic Copper Chalcogenide Nanocrystals with Tunable Optical Properties (Ilka Kriegel, Jessica Rodríguez-Fernández, Chengyang Jiang, Richard Schaller, Enrico Da Como, Dmitri V Talapin, Jochen Feldmann) Readership: Academics and professionals in the fields of physics, chemistry and material science.
Keywords:Nanostructure;Interface;Semiconductor;Nanoelectronics;Optics;SurfaceReviews: “This book provides an excellent introduction to the basics of ultrafast dynamics, describes advanced experimental methods and important applications to biological, charge transfer, low-dimensional systems and others. It is highly recommended to researchers and graduate students in the field of ultrafast laser spectroscopy.” Prof. Alan Heeger Nobel Laureate in Chemistry, 2000

Spectroscopy and Excitation Dynamics of Condensed Molecular Systems CRC Press

The advent of laser-based sources of ultrafast infrared pulses has extended the study of very fast molecular dynamics to the observation of processes manifested through their effects on the vibrations of molecules. In addition, non-linear infrared spectroscopic techniques make it possible to examine intra- and intermolecular interactions and how such interactions evolve on very fast time scales, but also in some instances on very slow time scales. Ultrafast Infrared Vibrational Spectroscopy is an advanced overview of the field of ultrafast infrared vibrational spectroscopy based on the scientific research of the leading figures in the field. The book discusses experimental and theoretical topics reflecting the latest accomplishments and understanding of ultrafast infrared vibrational spectroscopy. Each chapter provides background, details of methods, and explication of a topic of current research interest. Experimental and theoretical studies cover topics as diverse as the dynamics of water and the dynamics and structure of biological molecules. Methods covered include vibrational echo chemical exchange spectroscopy, IR-Raman spectroscopy, time resolved sum frequency generation, and 2D IR spectroscopy. Edited by a recognized leader in the field and with contributions from top researchers, including experimentalists and theoreticians, this book presents the latest research methods and results. It will serve as an excellent resource for those new to the field, experts in the field, and individuals who want to gain an understanding of particular methods and research topics.

On the Dynamics of Molecular Two-Photon Excitation Through Real Intermediate States CRC Press

This volume in the series brings together reknowned experts in the field to present

the reader with an account of the latest developments in quantum mechanics, molecular dynamics, and the teaching of computational chemistry. There are so many developments in the field of computational chemistry that it is difficult to keep track of them. The series was established to review the high volume of developments in the field. Rather than create a traditional article, each author approaches a topic to enable the reader to understand and solve problems and locate key references quickly. Each article has tutorial value. An updated compendium of software for molecular modeling appears as an appendix as in previous volumes. To the editors' knowledge, this is the most complete listing of sources of software for computational chemistry anywhere.

Photochemistry and Photophysics John Wiley & Sons

The Encyclopedia of Physical Chemistry and Chemical Physics introduces possibly unfamiliar areas, explains important experimental and computational techniques, and describes modern endeavors. The encyclopedia quickly provides the basics, defines the scope of each subdiscipline, and indicates where to go for a more complete and detailed explanation. Particular attention has been paid to symbols and abbreviations to make this a user-friendly encyclopedia. Care has been taken to ensure that the reading level is suitable for the trained chemist or physicist. The encyclopedia is divided in three major sections: FUNDAMENTALS: the mechanics of atoms and molecules and their interactions, the macroscopic and statistical description of systems at equilibrium, and the basic ways of treating reacting systems. The contributions in this section assume a somewhat less sophisticated audience than the two subsequent sections. At least a portion of each article inevitably covers material that might also be found in a modern, undergraduate physical chemistry text. METHODS: the instrumentation and fundamental theory employed in the major spectroscopic techniques, the experimental means for characterizing materials, the instrumentation and basic theory employed in the study of chemical kinetics, and the computational techniques used to predict the static and dynamic properties of materials. APPLICATIONS: specific topics of current interest and intensive research. For the practicing physicist or chemist, this encyclopedia is the place to start when confronted with a new problem or when the techniques of an unfamiliar area might be exploited. For a graduate student in chemistry or physics, the encyclopedia gives a synopsis of the basics and an overview of the range of activities in which physical principles are applied to chemical problems. It will lead any of these groups to the salient points of a new field as rapidly as possible and gives pointers as to where to read about the topic in more detail.

Relaxation Dynamics in Molecular Crystals Springer Science & Business Media

Harnessing the sun’s energy via photosynthesis is at the core of sustainable production of food, fuel, and materials by plants, algae, and cyanobacteria. Photosynthesis depends on photoprotection against intense sunlight, starting with the safe removal of excess excitation energy from the light-harvesting system, which can be quickly and non-destructively assessed via non-photochemical quenching of chlorophyll fluorescence (NPQ). By placing NPQ into the context of whole-organism function, this book aims to contribute towards identification of plant and algal lines with superior stress resistance and productivity. By addressing agreements and open questions concerning photoprotection’s molecular mechanisms, this book contributes towards development of artificial photosynthetic systems. A comprehensive picture –from single molecules to organisms in ecosystems, and from leading expert’s views to practical information for non-specialists on NPQ measurement and terminology – is presented.

Organic Nanophotonics Springer Science & Business Media

Condensed-matter physics plays an ever increasing role in photonics, electronic and atomic collisions research. Dispersion (Dynamics and Relaxation) includes scattering/collisions in the gaseous phase. It also includes thermal agitation, tunneling and relaxation in the liquid and solid phases. Classical mechanics, classical statistical mechanics, classical relativity and quantum mechanics are all implicated. 'Semiclassical' essentially means that there is a large or asymptotic real parameter. 'Semiclassical' can also mean 'classical with first-order quantal correction', based on an exponentiated Liouville series commencing with a simple pole in the -plane, being Planck's reduced constant and coming with all the attendant connection problems associated with the singularity at the turning or transition point and with the Stokes phenomenon. Equally,' semiclassical' can mean 'electrons described quantally and the heavy particles classically'. This latter gives rise to the so-called impact parameter method based on a pre-assigned classical trajectory. With evermore sophisticated experiments, it has become equally more important to test theory over a wider range of parameters. For instance, at low impact energies in heavy-particle collisions, the inverse velocity is a large parameter; in single-domain ferromagnetism, thermal agitation (including Brownian motion and continuous-time random walks) is faced with a barrier of height 'sigma', a possibly large parameter. Methods of solution include phase-integral analysis, integral transforms and change-of-dependent variable. We shall consider the Schrödinger time-independent and time-dependent equations, the Dirac equation, the Fokker Planck equation, the Langevin equation and the equations of Einstein's classical general relativity equations. There is an increasing tendency among physicists to decry applied mathematics and theoretical physics in favour of computational blackboxes. One may say applied mathematics concerns hard sums and products (and their inverses) but unless one can simplify and sum infinite series of products of infinite series, can one believe the results of a computer program? The era of the polymath has passed; this book proposal aims to show the relevance to, and impact of theory on, laboratory scientists.

Coherent Phenomena in Molecular Physics World Scientific

We characterize an isolated molecule by its compos~t~on, i.e. the number and types of atoms forming the molecule, its structure, i.e. the geometrical arrangement of the composite atoms with respect to each other, and its possible, i.e. quantum mechanically allowed, stationary energy states. Conceptually we separate the latter, being aware that this is an approximation, into electronic, vibrational and rotational states, including fine and hyperfine structure splittings. To be sure, there is an intimate relation between molecular structure and molecular energy states, in fact it is this relation we use, when we obtain structural information through spectroscopy, where we determine transitions between various stationary states of the molecule. The concepts above have proven extremely useful in chemistry and spectroscopy, however, the awareness of the limitations of these concepts has grown in recent years with the increasing recognition of (i) fluctional molecules, (ii) multiphoton absorption processes and (iii) influences due to the surroundings on "isolated" molecules.

Quantum Dynamics of Complex Molecular

Systems Frontiers Media SA
Since the first stimulated emission pumping (SEP) experiments more than a decade ago, this technique has proven powerful for studying vibrationally excited molecules. SEP is now widely used by increasing numbers of research groups to investigate fundamental problems in spectroscopy, intramolecular dynamics, intermolecular interactions, and even reactions. SEP provides rotationally pre-selected spectra of vibrationally highly excited molecules undergoing large amplitude motions. A unique feature of SEP is the ability to access systematically a wide variety of extreme excitations localized in various parts of a molecule, and to prepare populations in specific, high vibrational levels. SEP has made it possible to ask and answer specific questions about intramolecular vibrational redistribution and the role of vibrational excitation in chemical reactions.
Selective Excitation, Relaxation, and Energy Channeling in Molecular Systems John Wiley & Sons
This book combines in one concise volume the diverse work of several similar books in the market. Each chapter is self-contained and designed to serve the needs of graduates and undergraduates in physics, biochemistry and chemistry. Numerous illustrations accompany the material and more than 60 problems in molecular physics are worked out. Tedious mathematics that obscures the essence of physics is avoided. Though mainly theoretical, many important experimental aspects are included and discussed. It aims at teaching, and not commenting on scientific knowledge. An essential compendium, it can be used both as a textbook and a reference.The main features covered include: Quantum-mechanical treatment of molecular physics; theoretical treatment of molecular spectra and experimental techniques in spectroscopy; interatomic interactions, potentials, molecular stability, energy levels, bonds, rotational and vibrational states, anharmonicity, polarization; theoretical consideration of real molecules. Resonance methods (NMR, NQR, EPR and ENDOR. Theory, experimental apparatus, techniques, numerical results, applications and utility thereof).
Scientific and Technical Aerospace Reports Springer Science & Business Media
This work brings together quantum theory and spectroscopy to convey excitation processes to advanced students and specialists wishing to conduct research and understand the entire fi eld rather than just single aspects. Written by experienced authors and recognized authorities in the field, this text covers numerous applications and offers examples taken from different disciplines. As a result, spectroscopists, molecular physicists, physical chemists, and biophysicists will all fi nd this a must-have for their research. Also suitable as supplementary reading in graduate level courses.
Light Harvesting in Photosynthesis John Wiley & Sons
This book focuses the recent progress in nanophotonics technology to be used to develop novel nano-optical devices, fabrication technology, and advanced systems. It begins with a review of near-field excitation dynamics in molecules. Further topics include: wavelength up-converting a phonon-assisted excitation process with degenerate beams and non-degenerate beams in dye grains, a fabrication method of semiconductor quantum dots including self-assembly of InAs quantum dots based on the Stranski-Krastanov growth mode, single-nanotube spectroscopy and time-resolved spectroscopy for studying novel excitonic properties of single-walled carbon nanotubes. The striking features of ecxitons in the carbon nanotube, multiple-exciton states, and microfluidic and extended-nano fluidic techniques. These topics are reviewed by nine leading scientists. This overview is a variable resource for engineers and scientists working in the field of nanophotonics.
Intense Resonant Interactions in Quantum Electronics CRC Press
This landmark collective work introduces the physical, chemical, and biological principles underlying photosynthesis: light absorption, excitation energy transfer, and charge separation. It begins with an introduction to properties of various pigments, and the pigment proteins in plant, algae, and bacterial systems. It addresses the underlying physics of light harvesting and key spectroscopic methods, including data analysis. It discusses assembly of the natural system, its energy transfer properties, and regulatory mechanisms. It also addresses light-harvesting in artificial systems and the impact of photosynthesis on our environment. The chapter authors are amongst the field’s world recognized experts. Chapters are divided into five main parts, the first focused on pigments, their properties and biosynthesis, and the second section looking at photosynthetic proteins, including light harvesting in higher plants, algae, cyanobacteria, and green bacteria. The third part turns to energy transfer and electron transport, discussing modeling approaches, quantum aspects, photoinduced electron transfer, and redox potential modulation, followed by a section on experimental spectroscopy in light harvesting research. The concluding final section includes chapters on artificial photosynthesis, with topics such as use of cyanobacteria and algae for sustainable energy production. Robert Croce is Head of the Biophysics Group and full professor in biophysics of photosynthesis/energy at Vrije Universiteit, Amsterdam. Rienk van Grondelle is full professor at Vrije Universiteit, Amsterdam. Herbert van Amerongen is full professor of biophysics in the Department of Agrotechnology and Food Sciences at Wageningen University, where he is also director of the MicroSpectroscopy Research Facility. Ivo van Stokkum is associate professor in the Department of Physics and Astronomy, Faculty of Sciences, at Vrije Universiteit, Amsterdam.
Stability and Suppression of Turbulence in Relaxing Molecular Gas Flows Elsevier
Molecular Excitation Dynamics and RelaxationJohn Wiley & Sons
Photophysics of Molecular Materials North-Holland
New results from our laboratory on the two-photon absorption spectroscopy and photodissociation dynamics of NO2 are examined in the light of a simple nonperturbative theory for the time evolution of the intermediate state in a three-level system. Experiments on NO2 show effects distinct to two-photon excitation, evident spectroscopically in intense bent-to-linear origins and dynamically in unique patterns of energy disposal in two-photon photodissociation. We trace these effects to intramolecular relaxation which can be described by the evolution of an intermediate wave packet composed of a superposition of vibronic states prepared by the absorption of the first photon. Our theoretical treatment addresses the timescale for this evolution. Its results suggest that this timescale will depend on the intensity of the driving field, and so offer the intriguing possibility that the spectroscopy and dynamics of two-photon excitation through a system of real states will depend on laser intensity in a manner that tracks the time dependence of the intermediate wave packet.
CRC Press
This 3rd edition has been expanded and updated to account for recent developments, while new illustrative examples as well as an enlarged reference list have also been added. It naturally retains the successful concept of its predecessors in presenting a unified

perspective on molecular charge and energy transfer processes, thus bridging the regimes of coherent and dissipative dynamics, and establishing a connection between classic rate theories and modern treatments of ultrafast phenomena. Among the new topics are: - Time-dependent density functional theory - Heterogeneous electron transfer, e.g. between molecules and metal or semiconductor surfaces - Current flows through a single molecule. While serving as an introduction for graduate students and researchers, this is equally must-have reading for theoreticians and experimentalists, as well as an aid to interpreting experimental data and accessing the original literature.

Ultrafast Infrared Vibrational Spectroscopy World Scientific
This research program resulted in 53 publications. 43 already appeared, 4 are accepted for publication, and 6 were submitted. These publications are listed at the end of the final report. The research focused in the following major areas: (1) molecular semi-classical dynamics in Liouville space; a unified description of vibrational relaxation nonlinear spectroscopy and rate processes; (ii) intramolecular vibrational redistribution; (iii) vibrational and radiative dynamics in molecular clusters; (iv) coherent and spontaneous Raman, fluorescence and four-wave mixing spectroscopy; (v) excitation transport, electron transfer, and localization in disordered molecular systems. The main accomplishments are summarized in the final report. Molecular semiclassical dynamics, Vibrational relaxation, Nonlinear spectroscopy, Energy transfer, Molecular systems. (MJM).

Nonadiabatic Quantum Molecular Dynamics with Hopping World Scientific
Photonics concerns the generation, transport, processing and detection of light. It underlies a large amount of industrial activity, mainly devoted to information technology, telecommunications, environmental monitoring, biomedical science and instrumentation. The field has received a powerful impetus recently with the introduction of nanoscale concepts. Moreover, organic materials now appear as key components in photonic devices such as light-emitting diodes, integrated lasers, or photovoltaic cells. Organic molecular systems offer unique opportunities in nanophotonics since both top-down and bottom-up strategies can be pursued towards the nanoscale. This book gathers the proceedings of the NATO advanced research workshop on "Organic Nanophotonics", held in Aix-en-Provence, France, August 25-29, 2002. It constitutes a snapshot of the state of the art in the novel, emerging research area of nanophotonics based on organic molecules and materials.