I.S.Osad'ko

Selective Spectroscopy of Single Molecules



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# **Selective Spectroscopy Of Single Molecules**

Eli Barkai, Frank L H Brown, Michel Orrit, Haw Yang

## **Selective Spectroscopy Of Single Molecules:**

Selective Spectroscopy of Single Molecules Igor Osad'ko,2013-04-17 The main topic in this book is the low temperature selective spectroscopy of impurity centers It deals not only with the well developed methods of selective spectroscopy of molecular ensembles such as spectral hole burning fluorescence line narrowing and femtosecond photon echoes but also new methods of nanospectroscopy such as single molecule spectroscopy Both the ory and experimental data are discussed Theory united with experimental data enables one to organize the experimental facts This organization is of great importance especially for young researchers and students because it can provide better insight into the nature of the rather complicated dynamics of guest molecules in polymers and glasses where our understanding is still somewhat lacking The book mainly addresses young researchers and graduate students studying modern methods of spectroscopy of solid solutions For this rea son all formulas commonly used in practice are derived in this book The reader will also find new approaches and formulas which have been used by the author but are not well known to the majority researchers When the derivation of a formula seems rather complicated it is included in appendix The reader is then free to look the derivation up if he or she is interested Oth erwise the book can be read without reference to these sections The book includes many examples where theory helps us to interpret experimental data of various types for instance the data on line and hole broadening

Theory And Evaluation Of Single-molecule Signals Eli Barkai, Frank L H Brown, Michel Orrit, Haw Yang, 2008-10-24 This book reviews recently developed theoretical and numerical approaches to deal with optical and mechanical signals from individual molecules. The character of data generated by single molecules and more generally by single nano objects qualitatively differs from those obtained in conventional experiments on large ensembles of molecules Fluctuations randomness and irreproducibility are central to single molecule measurements and the specific methods required to extract reliable and statistically relevant information from them are presented here With contributions mainly from participants of the Theory Modeling and Evaluation of Single Molecule Measurements workshop held in Leiden the Netherlands on April 16 20 2007 this book is an authoritative compendium on the subject Shpol'skii Spectroscopy and Other Site-Selection **Methods** Johannes W. Hofstraat, 2000-08-07 Recent technological breakthroughs most notably in the field of lasers as well as detection and data processing have made it possible to apply high resolution molecular spectroscopy to such areas as environmental science bioanalysis and chemical physics This book describes recent advances and applications of high resolution molecular spectroscopy in low temperature solid matrices **Principles of Fluorescence Spectroscopy** Joseph R. Lakowicz, 2007-12-05 The third edition of this established classic text reference builds upon the strengths of its very popular predecessors Organized as a broadly useful textbook Principles of Fluorescence Spectroscopy 3rd edition maintains its emphasis on basics while updating the examples to include recent results from the scientific literature The third edition includes new chapters on single molecule detection fluorescence correlation spectroscopy novel probes and radiative decay

engineering Includes a link to Springer Extras to download files reproducing all book artwork for easy use in lecture slides This is an essential volume for students researchers and industry professionals in biophysics biochemistry biotechnology bioengineering biology and medicine **Single Molecule Spectroscopy** R. Rigler, M. Orrit, T. Basche, 2012-12-06 One often hears that nanoscience or in other words the knowledge and control of matter at length scales of a few nanometers will be the scientific frontier of the 21st century Although it has become almost commonplace this prediction deserves some justification The technological and scientific stakes of nanoscience indeed encompass many fields of science they include the ultimate miniaturization of electronic devices to acquire store and process information and also such basic endeavors as understanding the microscopic processes and patterns responsible for the physical properties of materials or the many unsolved questions raised by the astoundingly intricate workings of living matter Although the dream of observing and controlling matter at molecular scales is nearly as old as the very concept of molecules earlier attempts at practical realizations were hampered by a scarcity of suitable access to the nanoworld During the last two decades of the 20th century owing to the several new tools which have been developed to address objects at nanometer scales the nanoworld appears closer than ever within our reach A major class of methods in nanoscience are local probe microscopies such as scanning tunnelling or atomic force microscopies They require scanning a sharp tip with molecular dimensions across the surface of the sample under study and by direct action of the tip on the sample they make nano manipulations possible The present book is devoted to another class of methods the selection and study of single optically active nano objects by purely optical Fundamentals of Femtosecond Optics S A Kozlov, V V Samartsev, 2013-05-22 Femtosecond optics involves the means study of ultra short pulses of light Understanding the behaviour of these light pulses makes it possible to develop ultra fast lasers with a wide range of applications in such areas as medical imaging chemical analysis and micro machining Written by two leading experts in the field this book reviews the theory of the interaction of femtosecond light pulses with matter femtosecond lasers and laser systems and the principles of femtosecond coherent spectroscopy of impurity amorphous media reviews the theory of the interaction of femtosecond light pulses with matter Discusses femtosecond lasers and laser systems Considers the principles of femtosecond coherent spectroscopy of impurity amorphous media Single Molecule Tools, Part B: Super-Resolution, Particle Tracking, Multiparameter, and Force Based Methods ,2010-07-09 Single molecule tools have begun to revolutionize the molecular sciences from biophysics to chemistry to cell biology They hold the promise to be able to directly observe previously unseen molecular heterogeneities quantitatively dissect complex reaction kinetics ultimately miniaturize enzyme assays image components of spatially distributed samples probe the mechanical properties of single molecules in their native environment and just look at the thing as anticipated by the visionary Richard Feynman already half a century ago Single Molecule Tools Part B Super Resolution Particle Tracking Multiparameter and Force Based Methods captures a snapshot of this vibrant rapidly expanding field presenting articles from pioneers in the field intended to

guide both the newcomer and the expert through the intricacies of getting single molecule tools Includes time tested core methods and new innovations applicable to any researcher employing single molecule tools Methods included are useful to both established researchers and newcomers to the field Relevant background and reference information given for procedures can be used as a guide to developing protocols in a number of disciplines Laser Spectroscopy Wolfgang Demtröder, 2008-07-23 Keeping abreast of the latest techniques and applications this new edition of the standard reference and graduate text on laser spectroscopy has been completely revised and expanded While the general concept is unchanged the new edition features a broad array of new material This new edition has been completely revised especially the chapters on non linear spectroscopy ion trapping ultra short laser pulses and new developments Fifty new figures illustrate the newest developments and results The author is one of the most renowned experts in this area and no other book with this broad scope is available Handbook of Spectroscopy Genter Gauglitz, David S. Moore, 2014-05-05 This second thoroughly revised updated and enlarged edition provides a straightforward introduction to spectroscopy showing what it can do and how it does it together with a clear integrated and objective account of the wealth of information that may be derived from spectra It also features new chapters on spectroscopy in nano dimensions nano optics and polymer analysis Clearly structured into sixteen sections it covers everything from spectroscopy in nanodimensions to medicinal applications spanning a wide range of the electromagnetic spectrum and the physical processes involved from nuclear phenomena to molecular rotation processes In addition data tables provide a comparison of different methods in a standardized form allowing readers to save valuable time in the decision process by avoiding wrong turns and also help in selecting the instrumentation and performing the experiments These four volumes are a must have companion for daily use in every lab Light Harvesting in Photosynthesis Roberta Croce, Rienk van Grondelle, Herbert van Amerongen, Ivo van Stokkum, 2018-01-12 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 Ultrafast Phenomena XIV Takayoshi Kobayashi, Tadashi Okada, Tetsuro Kobayashi, Keith A. Nelson, Sandro de Silvestri, 2005-12-28 This volume is a collection of papers presented at the Fourteenth International Conference on Ultrafast Phenomena held in Niigata Japan from July 25 30 2004 The Ultrafast Phenomena Conferences are held every two years and provide a forum for discussion of the latest results in ultrafast optics and their applications in science and engineering A total of more than 300 papers were presented reporting the forefront of research in ultrashort pulse generation and characterization including new techniques for shortening the duration of laser pulses for stabilizing their absolute phase and for improving tenability over broad wavelength ranges output powers and peak intensities Ultrafast spectroscopies particularly time resolved X ray and electron diffraction and two dimensional spectroscopy continue to give new insights into fundamental processes in physics chemistry and biology Control and optimization of the outcome of ultrafast processes represent another important field of research There are an increasing number of applications of ultrafast methodology in material diagnostics and processing microscopy and medical imaging The enthusiasm of the participants the involvement of many students the high quality of the papers in both oral and poster sessions made the conference very successful Many people and organizations made invaluable contributions. The members of the international program committee reviewed the submissions and organized the program The staff of the Optical Society of America deserves special thanks for making the meeting arrangements and running the meeting smoothly *Chemistry of Nanomolecular Systems* Takayoshi Nakamura, Takuya Matsumoto, Hirokazu Tada, Ken-ichi Sugiura, 2013-03-14 Recently molecular electronics especially that utilizing single molecules has been attracting much attention This is mainly because the theoretical limit is approaching in the present silicon based technology and the development of an alternative process is strongly desired Single molecule electronics is aimed at a breakthrough toward the next generation of computing systems By designing and synthesizing highly functionalized molecules of nanometer size and incorporating these molecules into electrical circuits we shall obtain much dense and high speed processors The concept of single molecule electronics was first introduced by Aviram and Ratnar in 1978 In the early 1980s many groups all over the world had started research on molecular electronics At that time single molecule manipulation techniques had not been born and the research was mainly carried out on molecular films formed by the Langmuir Blodgett technique a wet process and by molecular beam epitaxy a dry process A number of prototypes of switching devices and logic gates were however reported in the 1980s In the early 1990s scanning probe microscopes became popular and researchers obtained a single molecule manipulation and evaluation tech nique It became possible to fabricate practical devices using single molecules or small numbers of molecules Finally at the end of the last century an explosion in the research field of single molecule electronics was witnessed In addition studies of biocomputing started in the early 1980s and significant progress was achieved in the last century **Encyclopedia of Chemical Physics and Physical** Chemistry: Applications Nicholas D. Spencer, John H. Moore, 2001 Encyclopedia of Chemical Physics and Physical

Chemistry John H. Moore, Nicholas D. Spencer, 2023-07-03 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

Advances in Laser Spectroscopy F. T. Arecchi, F. Strumia, H. Walther, 2012-12-06 Single-Molecule Studies of Nucleic Acids and Their Proteins David Bensimon, Vincent Croquette, Jean-François Allemand, Xavier Michalet, Terence Strick, 2018-11-30 This book provides the basis for understanding the elastic properties of nucleic acids DNA RNA the methods used to manipulate them e g optical magnetic and acoustic tweezers and traps and how to observe their interactions with proteins e g fluorescence microscopy FCS FRET etc It then exemplifies the use of these various methods in the study of three families of DNA enzymes polymerases helicases and topoisomerases. The book aims not to be exhaustive but rather to stimulate the imagination of readers in the application of these single molecule approaches to the study of DNA RNA and their interactions Single Particle Tracking and Single Molecule Energy Transfer Christoph Bräuchle, Don Carroll Lamb, Jens Michaelis, 2009-10-30 Closing a gap in the literature this handbook gathers all the information on single particle tracking and single molecule energy transfer It covers all aspects of this hot and modern topic from detecting virus entry to membrane diffusion and from protein folding using spFRET to coupled dye systems as well recent achievements in the field Throughout the first class editors and top international authors present content of the highest quality making this a must have for physical chemists spectroscopists molecular physicists and biochemists Single Molecule Dynamics in Life

Science Toshio Yanagida, Yoshiharu Ishii, 2008-11-24 In this first comprehensive resource to cover the application of single molecule techniques to biological measurements the pioneers in the field show how to both set up and interpret a single molecule experiment Following an introduction to single molecule measurements and enzymology the expert authors consider molecular motors and mechanical properties before moving on to the applications themselves Detailed discussions of studies on protein enzymes ribozymes and nucleic acids are also included Nuclear Fusion Research Robert E. H. Clark, Detlev Reiter, 2006-01-20 It became clear in the early days of fusion research that the effects of the containment vessel erosion of impurities degrade the overall fusion plasma performance Progress in controlled nuclear fusion research over the last decade has led to magnetically confined plasmas that in turn are sufficiently powerful to damage the vessel structures over its lifetime This book reviews current understanding and concepts to deal with this remaining critical design issue for fusion reactors It reviews both progress and open questions largely in terms of available and sought after plasma surface interaction data and atomic molecular data related to these plasma edge issues **Advanced Time-Correlated Single** Photon Counting Techniques Wolfgang Becker, 2005-12-19 In 1984 Desmond O Connor and David Phillips published their comprehensive book Time correlated Single Photon Counting At that time time correlated sigle photon counting or TCSPC was used primarily to record fluorescence decay functions of dye solutions in cuvettes From the beginning TCSPC was an am ingly sensitive and accurate technique with excellent time resolution However acquisition times were relatively slow due to the low repetition rate of the light sources and the limited speed of the electronics of the 70s and early 80s Moreover TCSPC was intrinsically one dimensional i e limited to the recording of the wa form of a periodic light signal Even with these limitations it was a wonderful te nique More than 20 years have elapsed and electronics and laser techniques have made impressive progress The number of transistors on a single chip has approximately doubled every 18 months resulting in a more than 1 000 fold increase in complity and speed The repetition rate and power of pulsed light sources have increased by about the same factor

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