

ELASTIC AND INELASTIC
SCATTERING IN ELECTRON
DIFFRACTION AND IMAGING



Zhong Lin Wang

[MOBI] Elastic And Inelastic Scattering In Electron Diffraction And Imaging (NATO Asi Series)

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Elastic and Inelastic Scattering in Electron Diffraction and Imaging-Zhong-lin Wang 2013-06-29 Elastic and inelastic scattering in transmission electron microscopy (TEM) are important research subjects. For a long time, I have wished to systematically summarize various dynamic theories associated with quantitative electron microscopy and their applications in simulations of electron diffraction patterns and images. This wish now becomes reality. The aim of this book is to explore the physics in electron diffraction and imaging and related applications for materials characterizations. Particular emphasis is placed on diffraction and imaging of inelastically scattered electrons, which, I believe, have not been discussed extensively in existing books. This book assumes that readers have some preknowledge of electron microscopy, electron diffraction, and quantum mechanics. I anticipate that this book will be a guide to approaching phenomena observed in electron microscopy from the prospects of diffraction physics. The SI units are employed throughout the book except for angstrom (Å), which is used occasionally for convenience. To reduce the number of symbols used, the Fourier transform of a real-space function $P(\mathbf{r})$, for example, is denoted by the same symbol $P(\mathbf{u})$ in reciprocal space except that \mathbf{r} is replaced by \mathbf{u} . Upper and lower limits of an integral in the book are $(-\infty, \infty)$ unless otherwise specified. The $(-\infty, \infty)$ integral limits are usually omitted in a mathematical expression for simplification. I very much appreciate opportunity of working with Drs. J. M. Cowley and J. C. H. Spence (Arizona State University), J.

Nuclear Data for Science and Technology-Syed M. Qaim 2012-12-06 This book describes the Proceedings of the International Conference on Nuclear Data for Science and Technology held at Jillich in May 1991. The conference was in a series of application oriented nuclear data conferences organized in the past under the auspices of the Nuclear Energy Agency-Nuclear Data Committee (NEANDC) and with the support of the Nuclear Energy Agency-Committee on Reactor Physics (NEACRP). It was the first international conference on nuclear data held in Germany, with the scientific responsibility entrusted to the Institute of Nuclear Chemistry of the Research Centre Jillich. The scientific programme was established by the International Programme Committee in consultation with the International Advisers, and the NEA and IAEA participated in the organization. A total of 328 persons from 37 countries and five international organizations participated. The scope of these Proceedings extends to a wide range of interdisciplinary topics dealing with measurement, calculation, evaluation and application of nuclear data, with a major emphasis on numerical data. Both energy and non-energy related applications are considered and due attention is given to some fundamental aspects relevant to the understanding of nuclear data.

Elementary Scattering Theory-D.S. Sivia 2011-01-06 This book provides the basic theoretical background for X-ray and neutron scattering experiments. Since these techniques are increasingly being used by biologists and chemists, as well as physicists, the book is intended to be accessible to a broad spectrum of scientists.

Nanodroplets-Zhiming M. Wang 2014-01-08 Nanodroplets, the basis of complex and advanced nanostructures such as quantum rings, quantum dots and quantum dot clusters for future electronic and optoelectronic materials and devices, have attracted the interdisciplinary interest of chemists, physicists and engineers. This book combines experimental and theoretical analyses of nanosized droplets which reveal many attractive properties. Coverage includes nanodroplet synthesis, structure, unique behaviors and their nanofabrication, including chapters on focused ion beam, atomic force microscopy, molecular beam epitaxy and the "vapor-liquid-solid" route. Particular emphasis is given to the behavior of metallic nanodroplets, water nanodroplets and nanodroplets in polymer and metamaterial nanocomposites. The contributions of leading scientists and their research groups will provide readers with deeper insight into the chemical and physical mechanisms, properties, and potential applications of various nanodroplets.

Coherent-Domain Optical Methods-Valery V. Tuchin 2004-10-15 For the first time in one set of books, coherent-domain optical methods are discussed in the framework of various applications, which are characterized by a strong light scattering. A few chapters describe basic research containing the updated results on coherent and polarized light non-destructive interactions with a scattering medium, in particular, diffraction, interference, and speckle formation at multiple scattering. These chapters allow for understanding coherent-domain diagnostic techniques presented in later chapters. A large portion of Volume I is dedicated to analysis of various aspects of optical coherence tomography (OCT) - a very new and growing field of coherent optics. Two chapters on laser scanning confocal microscopy give insight to recent extraordinary results on in vivo imaging and compare the possibilities and achievements of confocal, excitation multiphoton, and OCT microscopy. This two volume reference contains descriptions of holography, interferometry and optical heterodyning techniques in their application for diagnostics of turbid materials. The most prospective methods of coherent and polarization optical imaging and spectroscopy, including polarization-sensitive optical coherent tomography, polarization diffusion wave spectroscopy, and elastic and quasi-elastic light scattering spectroscopies and image techniques, are presented.

Radiation Mechanics-Esam M A Hussein 2010-07-07 Mechanics is the science of studying energy and forces, and their effects on matter. It involves mechanisms, kinematics, cross sections, and transport. Radiation mechanism describes how various types of radiation interact with different targets (atoms and nuclei). The book addresses the above four aspects of radiation mechanics integrating these aspects of radiation behavior in a single treatise under the framework of "radiation mechanics". Covers all aspects of radiation mechanics Helps non-nuclear graduates readily familiarize themselves with radiation Integrates and coordinates mechanisms, kinematics, cross sections and transport in one volume End of each chapter problems to further assist students in understanding the underlying concepts Use of computations and Internet resources included in the problems

Electron Diffraction Techniques-John Maxwell Cowley 1992 Designed for all those embarking on research which involves electron diffraction methods in physics, chemistry and geology, this volume contains information on EM imaging and diffraction contrast, disorder and defect scattering, electronic diffraction effects and identification of unknowns.

Transmission Electron Microscopy-David B. Williams 2009-07-31 This profusely illustrated text on Transmission Electron Microscopy provides the necessary instructions for successful hands-on application of this versatile materials characterization technique. The new edition also includes an extensive collection of questions for the student, providing approximately 800 self-assessment questions and over 400 questions suitable for homework assignment.

Magnas Under Pressure-Yoshio Kono 2018-04-06 Magnas under Pressure: Advances in High-Pressure Experiments on Structure and Properties of Melts summarizes recent advances in experimental technologies for studying magnas at high pressures. In the past decade, new developments in high-pressure experiments, particularly with synchrotron X-ray techniques, have advanced the study of magnas under pressure. These new experiments have revealed significant changes of structure and physical properties of magnas under pressure, which significantly improves our understanding of the behavior of magnas in the earth's interior. This book is an important reference, not only in the earth and planetary sciences, but also in other scientific fields, such as physics, chemistry, material sciences, engineering and in industrial applications, such as glass formation and metallurgical processing. Includes research and examples of high-pressure technologies for studying the structure and properties of magma Summarizes the current knowledge on the structure and properties of high-pressure magma Highlights the importance of magma in understanding the evolution of the earth's interior

Reflections on Experimental Science-Martin L. Perl 1996 This is a collection of important lecture and original articles and commentaries by Martin Perl, discoverer of the tau lepton and the third generation of elementary particles, and this year's Nobel Prize winner. This book contains a fascinating and realistic picture of experimental science based on the high energy physics research work carried out by him. Using reprints of his articles with his commentaries, the author presents the various aspects of experimental research in science: the pleasures and risks of experimental work; the pain and frustration with experiments that are useless or fail; the dreaming about experiments that were not carried out; the constant search for innovation and creativity in the work; and the special joy of discovery. The articles and commentaries range from the early days of bubble chambers and spark chambers in the 1950's to the author's present research, experiments at an electron-positron collider and a search for free quarks. The book is for the general reader as well as the scientist.

A Practical Guide to Quasi-elastic Neutron Scattering-Mark T F Telling 2020-07-07 The technique of Quasi-Elastic Neutron Scattering (QENS) is a powerful experimental tool for extracting temporal and spatial information at the nanoscale from both soft and hard condensed matter systems. However, while seemingly simple, the method is beset with sensitivities that, if ill considered, can hinder data interpretation and possibly publication. By highlighting key theoretical and data evaluation aspects of the technique, this specialised 'primer style' training resource encourages research success by guiding new researchers through a typical QENS experiment; from planning and sample preparation considerations to data reduction and subsequent analysis. Research examples are referenced throughout to illustrate the concepts addressed, with the book being written in such a way that it remains accessible to chemists, biologists, physicists, and materials scientists.

Neutron Scattering with a Triple-Axis Spectrometer-Gen Shirane 2002-02-21 Neutron scattering is an extremely powerful tool in the study of elemental excitations in condensed matter. This book provides a practical guide to basic techniques using a triple-axis spectrometer. Introductory chapters summarize useful scattering formulas and describe the components of a spectrometer, followed by a comprehensive discussion of the resolution function and focusing effects. Later sections include simple examples of phonon and magnon measurements, and an analysis of spurious effects in both inelastic and elastic measurements, and how to avoid them. Finally, polarization analysis techniques and their applications are covered. This guide will allow graduate students and experienced researchers new to neutron scattering to make the most efficient use of their experimental time.

Electron-Beam Interactions with Solids-Maurizio Dapor

Theory of Inelastic Scattering and Absorption of X-rays-Michel van Veenendaal 2015-01-26 Self-contained and comprehensive, this is the definitive guide to the theory behind X-ray spectroscopy.

Thermal Vibrations in Crystallography-Bertram Terence Martin Willis 1975

Lattice Dynamics-Alexei A. Maradudin 1969

Introduction to the Theory of Thermal Neutron Scattering-G. L. Squires 2012-03-29 A long-awaited reprint of the book that has established itself as the classic textbook on neutron scattering. It will be an invaluable introductory text for students taking courses on neutron scattering, as well as for researchers and those who would like to deepen their knowledge on the subject through self-study.

Deep Inelastic Scattering-Robin Devenish 2004 This is a self-contained account of deep inelastic scattering in high-energy physics. It covers the classic results which led to the quark-parton model of hadrons and the establishment of quantum chromodynamics as the theory of the strong nuclear force, in addition to new vistas in the subject.

Inelastic Scattering of X-Rays with Very High Energy Resolution-Eberhard Burkel 2006-04-11 Inelastic scattering of X-rays with very high energy resolution has finally become possible thanks to a new generation of high-intensity X-ray sources. This development marks the end to the traditional belief that low energy excitations like lattice vibrations cannot be resolved directly with X-rays. Inelastic scattering experiments allow to observe directly the small energy shifts of the photons. Studies of lattice vibrations, of excitations in molecular crystals, of collective excitations in liquids and electronic excitations in crystals demonstrating the broad applicability and power of this new technology are discussed in this book. The progress in this field opens up fantastic new research areas not only in physics but also in other disciplines such as materials science, biology and chemistry.

Radiochemistry and Nuclear Chemistry-Gregory Choppin 2001-12-03 Radiochemistry or Nuclear Chemistry is the study of radiation from an atomic or molecular perspective, including elemental transformation and reaction effects, as well as physical, health and medical properties. This revised edition of one of the earliest and best known books on the subject has been updated to bring into teaching the latest developments in research and the current hot topics in the field. In order to further enhance the functionality of this text, the authors have added numerous teaching aids that include an interactive website that features testing, examples in MathCAD with variable quantities and options, hotlinks to relevant text sections from the book, and online self-grading texts. As in the previous edition, readers can closely follow the structure of the chapters from the broad introduction through the more in depth descriptions of radiochemistry then nuclear radiation chemistry and finally the guide to nuclear energy (including energy production, fuel cycle, and waste management). New edition of a well-known, respected text in the specialized field of nuclear/radiochemistry Includes an interactive website with testing and evaluation modules based on exercises in the book Suitable for both radiochemistry and nuclear chemistry courses

Nuclear Reactions for Astrophysics-Ian J. Thompson 2009-07-02 Describes how the processes in stars which produce the chemical elements for planets and life may be reproduced in laboratories.

Statistical Mechanics-R K Pathria 2017-02-21 Statistical Mechanics discusses the fundamental concepts involved in understanding the physical properties of matter in bulk on the basis of the dynamical behavior of its microscopic constituents. The book emphasizes the equilibrium states of physical systems. The text first details the statistical basis of thermodynamics, and then proceeds to discussing the elements of ensemble theory. The next two chapters cover the canonical and grand canonical ensemble. Chapter 5 deals with the formulation of quantum statistics, while Chapter 6 talks about the theory of simple gases. Chapters 7 and 8 examine the ideal Bose and Fermi systems. In the next three chapters, the book covers the statistical mechanics of interacting systems, which includes the method of cluster expansions, pseudopotentials, and quantized fields. Chapter 12 discusses the theory of phase transitions, while Chapter 13 discusses fluctuations. The book will be of great use to

researchers and practitioners from wide array of disciplines, such as physics, chemistry, and engineering.

Quantum Mechanics-Mohammed Saleem 2016-01-07 Quantum mechanics has brought revolutionary changes in the conceptual foundations of physics and continues to shape the modern world. In this book the author's emphasis is on helping students comprehend the significance of the underlying principles and understand the ways the new concepts were introduced. Including many worked examples and problems this book will be an invaluable resource for students in physics, chemistry and electrical engineering needing a clear and rigorous introduction to quantum mechanics."

Direct nuclear Reactions-Norman Glendenning 2012-12-02 Direct Nuclear Reactions deals with the theory of direct nuclear reactions, their microscopic aspects, and their effect on the motions of the individual nucleons. The principal results of the theory are described, with emphasis on the approximations involved to understand how well the theory can be expected to hold under specific experimental conditions. Applications to the analysis of experiments are also considered. This book consists of 19 chapters and begins by explaining the difference between direct and compound nuclear reactions. The reader is then introduced to the theory of plane waves, some results of scattering theory, and the phenomenological optical potential. The following chapters focus on form factors and their nuclear structure content; the basis of the optical potential as an effective interaction; reactions such as inelastic single- and two-nucleon transfer reactions; the effect of nuclear correlations; and the role of multiple-step reactions. The theory of inelastic scattering and the relationship between the effective and free interactions are also discussed, along with reactions between heavy ions and the polarizability of nuclear wave functions during a heavy-ion reaction. This monograph will be of interest to nuclear physicists.

In Situ Characterization of Thin Film Growth-Gertjan Koster 2011-10-05 Advanced techniques for characterizing thin film growth in situ help to develop improved understanding and faster diagnosis of issues with the process. In situ characterization of thin film growth reviews current and developing techniques for characterizing the growth of thin films, covering an important gap in research. Part one covers electron diffraction techniques for in situ study of thin film growth, including chapters on topics such as reflection high-energy electron diffraction (RHEED) and inelastic scattering techniques. Part two focuses on photoemission techniques, with chapters covering ultraviolet photoemission spectroscopy (UPS), X-ray photoelectron spectroscopy (XPS) and in situ spectroscopic ellipsometry for characterization of thin film growth. Finally, part three discusses alternative in situ characterization techniques. Chapters focus on topics such as ion beam surface characterization, real time in situ surface monitoring of thin film growth, deposition vapour monitoring and the use of surface x-ray diffraction for studying epitaxial film growth. With its distinguished editors and international team of contributors, In situ characterization of thin film growth is a standard reference for materials scientists and engineers in the electronics and photonics industries, as well as all those with an academic research interest in this area. Chapters review electron diffraction techniques, including the methodology for observations and measurements Discusses the principles and applications of photoemission techniques Examines alternative in situ characterisation techniques

X-Ray and Neutron Diffraction-G. E. Bacon 2013-09-03 X-Ray and Neutron Diffraction describes the developments of the X-ray and the various research done in neutron diffraction. Part I of the book concerns the principles and applications of the X-ray and neutrons through their origins from classical crystallography. The book explains the use of diffraction methods to show the highly regular arrangement of atoms that forms a continuous pattern in three-dimensional space. The text evaluates the limitations and benefits of using the different types of radiation sources, whether these are X-rays, neutrons, or electrons. Part II is a collection of reprints discussing the development of techniques that includes a modification of the Bragg method, which is a method of X-ray crystal analysis. One paper presents an improved numerical method of two-dimensional Fourier synthesis for crystals. This method uses a greatly reduced process of arrangement of sets of figures found in the two-dimensional Fourier series. The book also notes the theoretical considerations and the practical details, and then addresses precautions against possible inclusions of errors in this method. The text deals as well with the magnetic scattering of neutrons, and one paper presents a simple method of gathering information about the magnetic moment of the neutron besides the traditional Stern-Gerlach method. Nuclear scientists and physicists, atomic researchers, and nuclear engineers will greatly appreciate the book.

Transmission Electron Microscopy and Diffractometry of Materials-Brent Fultz 2012-10-14 This book explains concepts of transmission electron microscopy (TEM) and x-ray diffractometry (XRD) that are important for the characterization of materials. The fourth edition adds important new techniques of TEM such as electron tomography, nanobeam diffraction, and geometric phase analysis. A new chapter on neutron scattering completes the trio of x-ray, electron and neutron diffraction. All chapters were updated and revised for clarity. The book explains the fundamentals of how waves and wavefunctions interact with atoms in solids, and the similarities and differences of using x-rays, electrons, or neutrons for diffraction measurements. Diffraction effects of crystalline order, defects, and disorder in materials are explained in detail. Both practical and theoretical issues are covered. The book can be used in an introductory-level or advanced-level course, since sections are identified by difficulty. Each chapter includes a set of problems to illustrate principles, and the extensive Appendix includes laboratory exercises.

Particle Penetration and Radiation Effects Volume 2-Peter Sigmund 2014-05-29 This book represents volume 2 of a 3-volume monograph on Particle Penetration and Radiation Effects. While volume 1 addressed the basic theory of scattering and stopping of swift point charges, i.e., protons, antiprotons and alpha particles, the present volume focuses on ions heavier than helium as well as molecules and clusters over an energy range from a few keV/u to a few hundred MeV/u. The book addresses the foundations in atomic-collision physics of a wide variety of application areas within materials and surface science and engineering, micro and nano science and technology, radiation medicine and biology as well as nuclear and particle physics. Problems have been added to all chapters. This should make the book useful for both self-study and advanced university courses. An effort has been made to establish a unified notation throughout the monograph.

Remote Compositional Analysis-Janice L. Bishop 2019-11-30 Comprehensive overview of the spectroscopic, mineralogical, and geochemical techniques used in planetary remote sensing.

Elastic and inelastic scattering of slow electrons by atoms and...-Hendrik Gerhardus Maria Heideman 1968

Clustering Phenomena in Atoms and Nuclei-Marten Brenner 2013-06-29 In these days of specialization it is important to bring together physicists working in diverse areas to exchange and share their ideas and excitement. This leads to cross-fertilization of ideas, and it enriches, as in biological systems, a specialized field with new strength, development and direction derived from another area. Although this might be an uncommon thing, it is an important step in our understanding of the physical world around us, which is, after all, the main purpose of physics. The seed for this conference was really sown when one of us (MB) and Mr. Manngård showed some a-scattering data at backward angles to FBM one summer about four years ago. That occasion led to a long research collaboration between the Abo Akademi physicists and other scientists in several countries. The actual idea to explore the possibility of holding a conference, however, crystallized in the summer of 1989 during a visit of FBM to Abo Akademi. The final decision to organize a conference was made after MB visited Profes sor Ben Mottelson in Copenhagen and Professor Anagnostatos in Athens. At this point it was recognized that there are similarities as well as differences between clustering phenomena in nuclei and systems consisting of atoms. It was therefore conjectured that it could be very stimulating to bring together these groups to exchange their ideas and to learn from each other's fields. A conference along these lines, we hoped, would contribute to an increased mutual understanding.

Materials Characterization Using Nondestructive Evaluation (NDE) Methods-Gerhard Huebschen 2016-03-23 Materials Characterization Using Nondestructive Evaluation (NDE) Methods discusses NDT methods and how they are highly desirable for both long-term monitoring and short-term assessment of materials, providing crucial early warning that the fatigue life of a material has elapsed, thus helping to prevent service failures. Materials Characterization Using Nondestructive Evaluation (NDE) Methods gives an overview of established and new NDT techniques for the characterization of materials, with a focus on materials used in the automotive, aerospace, power plants, and infrastructure construction industries. Each chapter focuses on a different NDT technique and indicates the potential of the method by selected examples of applications. Methods covered include scanning and transmission electron microscopy, X-ray microtomography and diffraction, ultrasonic, electromagnetic, microwave, and hybrid techniques. The authors review both the determination of microstructure properties, including phase content and grain size, and the determination of mechanical properties, such as hardness, toughness, yield strength, texture, and residual stress. Gives an overview of established and new NDT techniques, including scanning and transmission electron microscopy, X-ray microtomography and diffraction, ultrasonic, electromagnetic, microwave, and hybrid techniques Reviews the determination of microstructural and mechanical properties Focuses on materials used in the automotive, aerospace, power plants, and infrastructure construction industries Serves as a highly desirable resource for both long-term monitoring and short-term assessment of materials

Nanoscale Energy Transport and Conversion-Gang Chen 2005-03-03 This is a graduate level textbook in nanoscale heat transfer and energy conversion that can also be used as a reference for researchers in the developing field of nanoengineering. It provides a comprehensive overview of microscale heat transfer, focusing on thermal energy storage and transport. Chen broadens the readership by incorporating results from related disciplines, from the point of view of thermal energy storage and transport, and presents related topics on the transport of electrons, phonons, photons, and molecules. This book is part of the MIT-Pappalardo Series in Mechanical Engineering.

Optical Measurements-Franz Mayinger 2013-03-14 Increasing possibilities of computer-aided data processing have caused a new revival of optical techniques in many areas of mechanical and chemical engineering. Optical methods have a long tradition in heat and mass transfer and in fluid dynamics. Global experimental information is not sufficient for developing constitution equations to describe complicated phenomena in fluid dynamics or in transfer processes by a computer program . Furthermore, a detailed insight with high local and temporal resolution into the thermo-and fluiddynamic situations is necessary. Sets of equations for computer program in thermo dynamics and fluid dynamics usually consist of two types of formulations: a first one derived from the conservation laws for mass, energy and momentum, and a second one mathematically modelling transport processes like laminar or turbulent diffusion. For reliably predicting the heat transfer, for example, the velocity and temperature field in the boundary layer must be known, or a physically realistic and widely valid correlation describing the turbulence must be available. For a better understanding of combustion processes it is necessary to know the local concentration and temperature just ahead of the flame and in the ignition zone.

Elastic and Inelastic Scattering of 18.6 MeV Protons by 68Zn, 90Zr, and 114Cd-Daryl Ray Tweeton 1973

Spin-Wave Theory and its Applications to Neutron Scattering and THz Spectroscopy-Randy S Fishman 2018-11-05 Two of the most powerful tools used to study magnetic materials are inelastic neutron scattering and THz spectroscopy. Because the measured spectra provide a dynamical fingerprint of a magnetic material, those tools enable scientists to unravel the structure of complex magnetic states and to determine the microscopic interactions that produce them. This book discusses the experimental techniques of inelastic neutron scattering and THz spectroscopy and provides the theoretical tools required to analyze their measurements using spin-wave theory. For most materials, this analysis can resolve the microscopic magnetic interactions such as exchange, anisotropy, and Dzyaloshinskii-Moriya interactions. Assuming a background in elementary statistical mechanics and a familiarity with the quantized harmonic oscillator, this book presents a comprehensive review of spin-wave theory and its applications to both inelastic neutron scattering and THz spectroscopy. Spin-wave theory is used to study several model magnetic systems, including non-collinear magnets such as spirals and cycloids that are produced by geometric frustration, competing exchange interactions, or Dzyaloshinskii-Moriya interactions. Several case studies utilizing spin-wave theory to analyze inelastic neutron-scattering and THz spectroscopy measurements are presented. These include both single crystals and powders and both oxides and molecule-based magnets. In addition to sketching the numerical techniques used to fit dynamical spectra based on microscopic models, this book also contains over 70 exercises that can be performed by beginning graduate students.

Introduction to Nuclear Reactions-G. R. Satchler 1990-02-09 The past decade has seen a remarkable growth in the extent and variety of experiments being done on nuclear reactions. The purpose of this book is to understand the results of the measurements gained in these experiments rather than to describe how they are made.

Nuclear and Particle Physics-Claude Amsler 2015-05 An introductory course on nuclear and particle physics for undergraduate and early-grade students. It covers the fundamentals of both nuclear and particle physics, giving emphasis to the discovery and history of developments in the field, and is experimentally/phenomenologically oriented.

Measurements of the Differential Cross Sections for Elastic and Inelastic Scattering of 14 MeV Neutrons in Natural Chromium, Iron, and Nickel-Emmanuel G. Christodoulou 1996

Optical Radiometry for Ocean Climate Measurements- 2014-11-13 This book presents the state-of-the-art of optical remote sensing applied for the generation of marine climate-quality data products, with contributions by international experts in the field. The chapters are logically grouped into six thematic parts, each introduced by a brief overview. The different parts include: i. requirements for the generation of climate data records from satellite ocean measurements and additionally basic radiometry principles addressing terminology, standards, measurement equation and uncertainties; ii. satellite visible and thermal infrared radiometry embracing instrument design, characterization and, pre- and post-launch calibration; iii. in situ visible and thermal infrared radiometry including overviews on basic principles, technology and measurements methods required to support satellite missions devoted to climate change investigations; iv. simulations as fundamental tools to support interpretation and analysis of both in situ and satellite radiometric measurements; v. strategies for in situ radiometry to satisfy mission requirements for the generation of climate data records; and finally, vi. methods for the assessment of satellite data products. Fundamentals of measurement theory are taken through to implementation of practical ground based radiometers and their application to validate satellite data used to generate climate data records. This book presents practical solutions for those involved or contemplating the validation of optical climate measurements from satellite instruments. Exhaustive coverage of important topics Fundamental and advanced discussions of many types of instruments Emphasis on calibration and uncertainty analysis of results