

MEDICAL APPLICATIONS OF ACCELERATORS

Reviews of Accelerator Science and Technology Vol. 2 and Other Medical Physics Titles

REVIEWS OF ACCELERATOR SCIENCE AND TECHNOLOGY

Volume 2: Medical Applications of Accelerators

edited by

Alexander W Chao (SLAC National Accelerator Laboratory, USA) &
Weiren Chou (Fermi National Accelerator Laboratory, USA)

“This book in particular comes at an auspicious moment because the synergies between the science behind accelerators and the related spin-offs, such as the applications of accelerators to fight disease, are of great importance to human health — with a profound impact on our society.”

CERN Courier

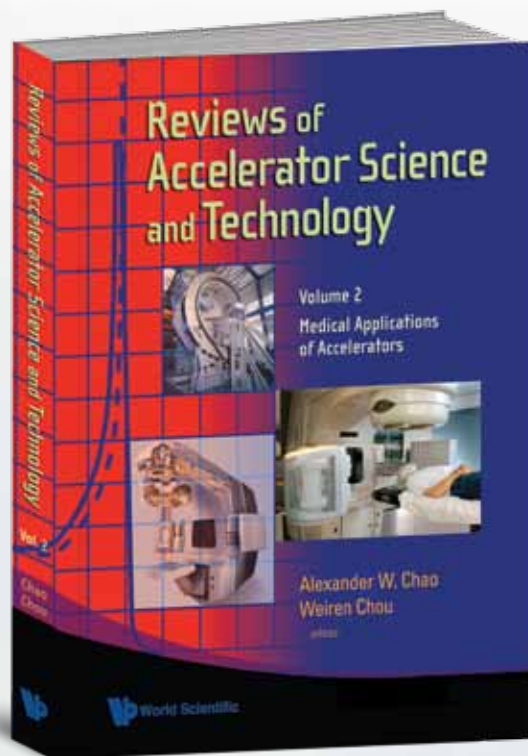
The theme of this volume, “Medical Applications of Accelerators”, is of enormous importance to human health and has a deep impact on our society.

The invention of particle accelerators in the early 20th century created a whole new world for producing energetic X-rays, electrons, protons, neutrons and other particle beams. Immediately these beams found revolutionary applications in medicine. There are two important yet distinct medical applications. One is that accelerators produce radioisotopes for various nuclear medicines for millions of patients each year. The other is that accelerators produce particle beams for radiation therapy for the treatment of cancer. The particle beams can be X-rays (generated by high-energy electrons), protons, neutrons or heavy ions such as carbon. Today there are more than 5,000 accelerators routinely used in hospitals all over the world for nuclear medicine and cancer therapy. The great potential of accelerator applications in medicine can hardly be exaggerated.

This volume contains 14 articles, all written by distinguished scholars.

Contents: Physical and Biological Basis of Proton and of Carbon Ion Radiation Therapy and Clinical Outcome Data (H Suit et al.); The Production of Radionuclides for Radiotracers in Nuclear Medicine (T J Ruth); Proton Radiation Therapy in the Hospital Environment: Conception, Development, and Operation of the Initial Hospital-Based Facility (J M Slater et al.); Microwave Electron Linacs for Oncology (D H Whittum); Heavy-Particle Radiotherapy: System Design and Application (HTsujii et al.); High Frequency Linacs for Hadrontherapy (U Amaldi et al.); Medical Cyclotrons (D L Friesel & T A Antaya); Synchrotrons for Hadrontherapy (M G Pullia); Beam Delivery Systems for Particle Radiation Therapy: Current Status and Recent Developments (J M Schippers); Laser Acceleration of Ions for Radiation Therapy (T Tajima et al.); FFAGs as Accelerators and Beam Delivery Devices for Ion Cancer Therapy (D Trbojevic); The Dielectric Wall Accelerator (G J Caporaso et al.); The Supercollider: The Texas Days — A Personal Recollection of Its Short Life and Demise (S Wojcicki); A Man for All Seasons: Robert R Wilson (E L Goldwasser).

Readership: Physicists, engineers and medical practitioners in accelerator science.



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320pp
978-981-4299-34-3
978-981-4299-35-0(ebook)

Dec 2009
US\$108 £81
US\$140

DEVELOPMENT OF BIOLOGICALLY OPTIMIZED RADIATION THERAPY ★TEXTBOOK

edited by **Anders Brahme** (Karolinska Institutet, Sweden)

The book covers the biological, physical and clinical background of advanced biologically based radiation therapy optimization with focus on modern radiation therapy modalities such as electron, photon and light ion therapy. Highly recommended for its strong interdisciplinary profile, the book contains a meritorious compilation of previously unpublished materials in many areas of modern science. Undergraduates, researchers and practitioners such as oncologists, medical physicists and radiation biologists alike should find the book immensely informative and comprehensively thorough.

Readership: Oncologists, medical physicists, radiation biologists, molecular oncologists, radiation therapists, radiation physicists, undergraduates and graduates studying or doing research on medical imaging.

450pp Spring 2012
978-981-4277-75-4 US\$102 £70

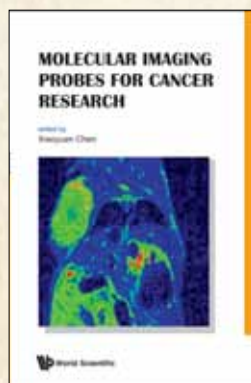
MOLECULAR IMAGING PROBES FOR CANCER RESEARCH

edited by **Xiaoyuan Chen** (National Institutes of Health, USA)

This review volume integrates the advances in cancer biology, molecular imaging techniques and imaging probes for visualization and quantitative measurement of anatomical, functional, and molecular profiles of cancer. The volume also presents a comprehensive summary of the state-of-the-art technology in molecular imaging probe design and applications in radionuclide (PET and SPECT), magnetic resonance (MR), optical (fluorescence, Raman, photoacoustic), ultrasound, CT, and multimodality imaging.

Readership: Postgraduates, academics and researchers interested in diagnostic technology in cancer research.

1100pp Fall 2011
978-981-4293-67-9 US\$260 £169
978-981-4293-68-6(ebook) US\$338



OPTICAL DETECTION OF CANCER

edited by **Arlen D Meyers** (University of Colorado Denver, USA)

Significant progress in engineering has allowed the production of devices that can optically detect, differentiate and treat surface or near-surface cancers. The ability to differentiate cancerous from non-cancerous tissue *in vitro* using light represents a potentially significant advance in patient care, eliminating needless repeat procedures. With the help of advanced optical technologies, clinicians are able to identify cancers earlier, determine surgical margins at the time of surgery, and monitor treatment results without using expensive and insensitive imaging.

This volume describes the state-of-the-art optical detection technologies in varying stages of cancer development.

Readership: Researchers and medical professionals who are interested in the biophotonic detection of cancer, including oral surgeons, general surgeons, otolaryngologists, and primary-care physicians.

200pp Fall 2011
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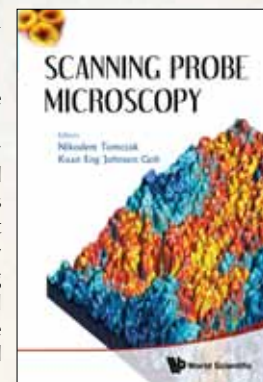
SCANNING PROBE MICROSCOPY

edited by **Nikodem Tomczak & Kuan Eng Johnson Goh** (A*STAR, Singapore)

The rising importance of SPM demands a concise treatment in the form of a book which is accessible to interdisciplinary practitioners. This book highlights recent advances in the field of SPM with sufficient depth and breadth to provide an intellectually stimulating overview of the current state of the art. The book is based on a set of carefully selected original works from renowned contributors on topics that range from scanning tunneling spectroscopy of self-assembled nanostructures, scanning force microscopy applications in biology and materials science down to the single molecule level, novel scanning probe techniques, and nanolithography.

Readership: Academics, professionals and final year undergraduates in materials science and nanotechnology.

276pp Dec 2010
978-981-4324-76-2 US\$98 £61
978-981-4324-77-9(ebook) US\$127



PROJECTION NMR SPECTROSCOPY

Theory and Applications

by **Thomas Szyperki** (State University of New York at Buffalo, USA) & **Hanudatta S Atreya** (Indian Institute of Science, India)

This book contains three sections covering theory, acquisition, processing and analysis of NMR data, and applications of projection NMR. The first section reviews how methodology and theory of projection NMR evolved since the 1970s; the second section serves as a guide for researchers in the field to become acquainted with the practical aspects of projection NMR, and will provide all information on how to acquire, process and analyze projection NMR data; and the last section covers current applications, primarily in structural biology and metabonomics. Future developments and perspectives in projection NMR are also discussed thoroughly.

Readership: Biophysicists; biochemists; graduate students, post-doctoral researchers and scientists in industry.

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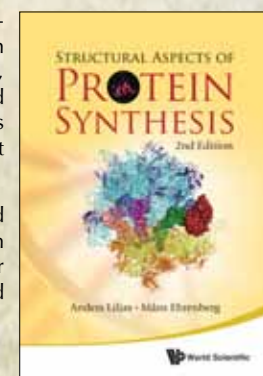
STRUCTURAL ASPECTS OF PROTEIN SYNTHESIS (2nd Edition)

by **Anders Liljas** (Lund University, Sweden) & **Måns Ehrenberg** (Uppsala University, Sweden)

This highly illustrated book provides an up-to-date description of the structure and function of the translation system including ribosomes, tRNAs, translation factors, antibiotics and aminoacyl-tRNA synthetases. The book provides a comprehensive overview of translation in light of the structural results.

Readership: Upper level undergraduates and graduate students with an interest in protein synthesis; researchers in cell and molecular biology, biochemistry and biophysics who need to get an overview of translation.

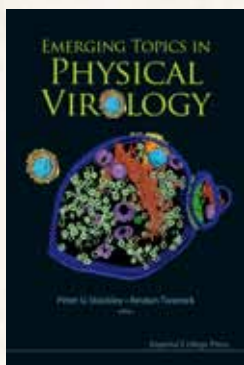
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978-981-4313-21-6(pbk) US\$65 £45
978-981-4313-22-3(ebook) US\$164



EMERGING TOPICS IN PHYSICAL VIROLOGY

edited by **Peter G Stockley** (University of Leeds, UK) &
Reidun Twarock (University of York, UK)

It is the first interdisciplinary book that integrates a review of relevant experimental techniques, such as cryo-electron microscopy, atomic force microscopy and mass spectrometry with the latest results on the biophysical and mathematical modeling of viruses. The book comprehensively covers the structure and physical properties of the protein envelopes that encapsulate and hence protect the delicate viral genome, their assembly and disassembly, the organization of the viral genome and applications of viruses in Biomedical Nanotechnology.



Readership: Biologists, biophysicists, chemists, clinicians and mathematical biologists interested in virus structure, function and dynamics.

332pp Mar 2010
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THE RAINBOW AND THE WORM (3rd Edition)

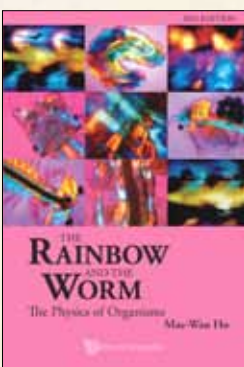
The Physics of Organisms

by **Mae-Wan Ho** (Institute of Science in Society, UK)

“... ‘what is life?’ Mae-Wan Ho presents an interconnected system of proposals, experimental results and conjectures which go a long way towards providing an entirely new answer to this question. It is based on research which is mainstream in its theoretical physical foundations, though innovative in some of its techniques...”

Network

Readership: Sixth-form and undergraduate students in physics and biology; biophysics, biochemistry and quantum mechanics undergraduates.



408pp Aug 2008
978-981-283-259-7 US\$58 £32
978-981-283-260-3(pbk) US\$34 £18

★BESTSELLING TEXTBOOK

AN INTRODUCTION TO THE PRINCIPLES OF MEDICAL IMAGING (Revised Edition)

by **Chris Guy** (Imperial College, London, UK) &
Dominic ffytche (Institute of Psychiatry, London, UK)

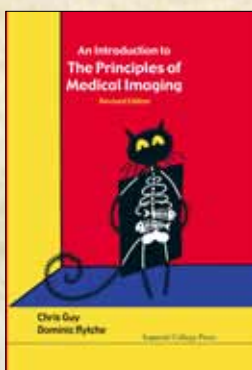
Review of the First Edition:

“This book manages to cover a wide range of subjects in a relatively compact way and could form a useful introductory text ... It is full of many historical details and these are interesting. There are lots of useful technical details in this book and the authors frequently illustrate the formulae they provide with specific numerical examples which helps to put them in context.”

Medical Engineering & Physics

Readership: Undergraduates in engineering and physics doing a medical physics option; postgraduates doing medical research.

420pp Jun 2005
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**ATOMIC FORCE MICROSCOPY FOR BIOLOGISTS (Second Edition)**

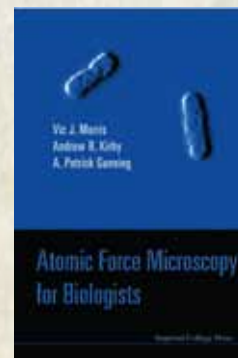
by **Victor J Morris, Andrew R Kirby & A Patrick Gunning**
(Institute of Food Research, Norwich Research Park, UK)

“This second edition of an excellent book updates considerably the information contained, and is expanded, too... The chapters are in-depth and very informative, and contain lots of useful and detailed information... well written with an informal style... including detailed information on how to carry out some experiments, answers to common questions, etc. ... Overall this book is highly recommended for those wishing to get an overview of the biological applications of AFM.”

Peter Eaton, University of Porto, Portugal

Readership: Undergraduates, postgraduates and researchers in biophysics.

420pp Aug 2009
978-1-84816-467-3 US\$65 £45
978-1-84816-468-0(ebook) US\$85

**PHYSICAL BIOLOGY From Atoms to Medicine**

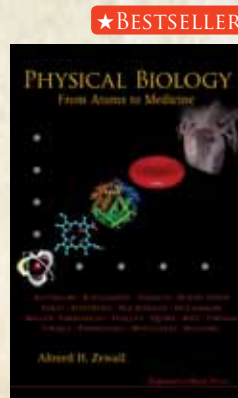
edited by **Ahmed H Zewail**
(California Institute of Technology, USA)

“The scope of this collection of overviews of the present state and future possible developments in physical biology is very broad... Anyone interested in how physics, engineering and mathematics can contribute to research in biology and medicine, be it on the molecular level or on the healthcare level, should be able to find useful information and inspiration in this book.”

Acta Paediatrica

Readership: Graduate students and researchers in life sciences, biochemistry and biophysics.

584pp May 2008
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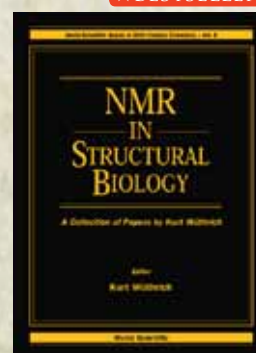
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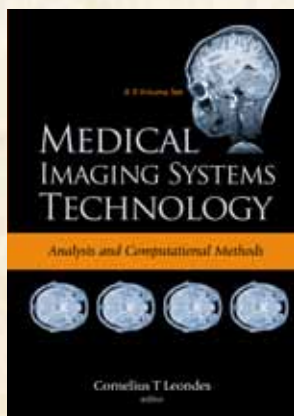
edited by **Cornelius T Leondes** (University of California, Los Angeles, USA)

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Journal of Innovative Optical Health Sciences (JIOHS)



Special Topic

We are pleased to announce the publication of a new special topic section, focusing on laser-tissue interactions and development of diagnostic and therapeutic devices for medicine and biology using optical technologies in honor of professor Steven L. Jacques of his 60th birthday. Steven Jacques developed the use of Monte Carlo computer simulations to study optical transport in biological tissues, which is now widely used in the field of biophotonics. As a pioneer in the field of biomedical optics, he has been highly prolific. He has authored over 100 papers in peer-reviewed journals in addition to inventing one of the most widely used devices in biomedical optics. He has trained numerous researchers in our field. Some of them - including Jessica C. Ramella-Roman, Kunio Awazu, Andreas Hielscher, and myself - along with friends - including Stephen Boppart, Britton Chance, Shoko Nioka, Sergio Fantini, Wei Chen, Ricky Wang, and Yuan-Di Zhao - graciously contributed to this special section celebrating Steve 60th birthday.

Research Highlights

A Diffusion-Transport Hybrid Method for Accelerating Optical Tomography

Kim, H. K. and A. H. Hielscher

JIOHS, 2010. 3(4): p. 293-305

Label-Free 3D Optical Microangiography Imaging of Functional Vasa Nervorum and Peripheral Microvascular Tree in the Hind Limb of Diabetic Mice

Jia, Y., T. K. Baumann and R. K. Wang

JIOHS, 2010. 3(4): p. 307-313

Near-Infrared, Broad-Band Spectral Imaging of the Human Breast for Quantitative Oximetry: Applications to Healthy and Cancerous Breasts

Yu, Y., A. Sassaroli, D.K. Chen, M. J. Homer, R. A. Graham and S. Fantini

JIOHS, 2010. 3(4): p. 267-277

PARTICLE COLLISIONS AND QUANTITATIVE SPECTROSCOPY IN INTERDISCIPLINARY RESEARCH

Editor-in-Chief: **Dževad Belkić**

Professor of Mathematical Radiation Physics

Nobel Medical University, Karolinska Institute, Stockholm, Sweden

This Series gives unique and expert coverage of cutting-edge advances of theory and experiments on collisions and spectroscopy in interdisciplinary research. These two main strategies for studying the structure of matter on vastly different levels are deeply and fundamentally intertwined through a panoply of similar or common concepts as well as via mathematical and computational methods, both deterministic and stochastic.

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