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**KEY=LUMINESCENCE - BROOKS LILLY**

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## Optically Stimulated Luminescence Dosimetry

*Elsevier Optically Stimulated Luminescence (OSL) has become the technique of choice for many areas of radiation dosimetry. The technique is finding widespread application in a variety of radiation dosimetry fields, including personal monitoring, environmental monitoring, retrospective dosimetry (including geological dating and accident dosimetry), space dosimetry, and many more. In this book we have attempted to synthesize the major advances in the field, covering both fundamental understanding and the many applications. The latter serve to demonstrate the success and popularity of OSL as a dosimetry method. The book is designed for researchers and radiation dosimetry practitioners alike. It delves into the detailed theory of the process from the point of view of stimulated relaxation phenomena, describing the energy storage and release processes phenomenologically and developing detailed mathematical descriptions to enable a quantitative understanding of the observed phenomena. The various stimulation modes (continuous wave, pulsed, or linear modulation) are introduced and compared. The properties of the most important synthetic OSL materials beginning with the dominant carbon-doped Al<sub>2</sub>O<sub>3</sub>, and moving through discussions of other, less-well studied but nevertheless important, or potentially important, materials. The OSL properties of the two most important natural OSL dosimetry material types, namely quartz and feldspars are discussed in depth. The applications chapters deal with the use of OSL in personal, environmental, medical and UV dosimetry, geological dating and retrospective dosimetry (accident dosimetry and dating). Finally the*

developments in instrumentation that have occurred over the past decade or more are described. The book will find use in those laboratories within academia, national institutes and the private sector where research and applications in radiation dosimetry using luminescence are being conducted. Potential readers include personnel involved in radiation protection practice and research, hospitals, nuclear power stations, radiation clean-up and remediation, food irradiation and materials processing, security monitoring, geological and archaeological dating, luminescence studies of minerals, etc.

## Optically Stimulated Luminescence Fundamentals and Applications

John Wiley & Sons *Optically stimulated luminescence has developed into one of the leading optical techniques for the measurement and detection of ionizing radiation. This text covers, in a readable manner, advanced modern applications of the technique, how it can play a useful role in different areas of dosimetry and how to approach the challenges presented when working with optically stimulated luminescence. The six chapters are as follows: Introduction, including a short history of OSL and details of successful applications Theory and Practical Aspects Personal Dosimetry Space Dosimetry Medical Dosimetry Other Applications and Concepts, including retrospective and accident dosimetry, environmental monitoring and UV dosimetry Throughout the book, the underlying theory is discussed on an as-needed basis for a complete understanding of the phenomena, but with an emphasis of the practical applications of the technique. The authors also give background information and relevant key references on each method, inviting the reader to explore deeper into the subject independently. Postgraduates, researchers, and those involved with radiation dosimetry will find this book particularly useful. The material is both relevant and accessible for both specialists and those new to the field, therefore is fundamental to any academic interested in modern advances of the subject.*

## Optically Stimulated Luminescence (OSL) and Its Applications in Radiation Therapy Dosimetry Thermally and Optically Stimulated

# Luminescence

## A Simulation Approach

*John Wiley & Sons Thermoluminescence (TL) and optically stimulated luminescence (OSL) are two of the most important techniques used in radiation dosimetry. They have extensive practical applications in the monitoring of personnel radiation exposure, in medical dosimetry, environmental dosimetry, spacecraft, nuclear reactors, food irradiation etc., and in geological /archaeological dating. Thermally and Optically Stimulated Luminescence: A Simulation Approach describes these phenomena, the relevant theoretical models and their prediction, using both approximations and numerical simulation. The authors concentrate on an alternative approach in which they simulate various experimental situations by numerically solving the relevant coupled differential equations for chosen sets of parameters. Opening with a historical overview and background theory, other chapters cover experimental measurements, dose dependence, dating procedures, trapping parameters, applications, radiophotoluminescence, and effects of ionization density. Designed for practitioners, researchers and graduate students in the field of radiation dosimetry, Thermally and Optically Stimulated Luminescence provides an essential synthesis of the major developments in modeling and numerical simulations of thermally and optically stimulated processes.*

## Advances In Physics And Applications Of Optically And Thermally Stimulated Luminescence

*World Scientific In this volume, international leading experts in the study of thermally and optically luminescence give an up-to-date, comprehensive coverage of the theoretical and experimental aspects of these subjects, as well as their applications. The theory of thermoluminescence (TL) and optically stimulated luminescence (OSL) are discussed in detail including mainly solid state models of localized and delocalized transitions. These models cover the effects occurring during the excitation by irradiation and the read-out by heating or by exposure to light. The methods described consist of analytical mathematical considerations as well as numerical simulations. The main application of these effects, namely radiation dosimetry, includes personal and environmental dosimetry, as well as retrospective dosimetry and the dosimetry of cosmic radiation and space missions. Also discussed in detail are archaeological and geological dating, the use of luminescence dosimetry in medical physics as well as general applications in geosciences, other model*

subjects such as time-resolved luminescence and thermally assisted OSL, and the sister-subject of thermoluminescence in photosynthetic materials.

# Low Dose Retrospective Radiation Dosimetry Using Optically Stimulated Luminescence in Household Salt

## A Course in Luminescence Measurements and Analyses for Radiation Dosimetry

*John Wiley & Sons A Course in Luminescence Measurements and Analyses for Radiation Dosimetry A complete approach to the three key techniques in luminescence dosimetry In A Course in Luminescence Measurements and Analyses for Radiation Dosimetry, expert researcher Stephen McKeever delivers a holistic and comprehensive exploration of the three main luminescence techniques used in radiation dosimetry: thermoluminescence, optically stimulated luminescence, and radiophotoluminescence. The author demonstrates how the three techniques are related to one another and how they compare to each other. Throughout, the author's focus is on pedagogy, including state-of-the-art research only where it is relevant to demonstrate a key principle or where it reveals a critical insight into physical mechanisms. The primary purpose of the book is to teach beginning researchers about the three aforementioned techniques, their similarities and distinctions, and their applications. A Course in Luminescence Measurements and Analyses for Radiation Dosimetry offers access to a companion website that includes original data sets and problems to be solved by the reader. The book also includes: A thorough introduction to the field of luminescence applications in radiation dosimetry, including a history of the subject. Comprehensive explorations of introductory models and kinetics, including the concepts of thermoluminescence, optically stimulated luminescence, and radiophotoluminescence. Practical discussions of luminescence curve shapes, including the determination of trapping parameters from experimental thermoluminescence and optically stimulated luminescence data. In-depth examinations of dose-response functions, superlinearity, supralinearity, and sublinearity, as well as the causes of non-linearity. Detailed examples with well-known materials. A Course in Luminescence Measurements and Analyses for Radiation Dosimetry is an invaluable guide for undergraduate and graduate students in the field of radiation dosimetry, as well as*

faculty and professionals in the field.

## Methodological Developments for Application of Optically Stimulated Luminescence (OSL) in Medical Dosimetry

## Neutron Dosimetry Using Optically Stimulated Luminescence

## Radiation Dosimetry Phosphors

## Synthesis, Mechanisms, Properties and Analysis

*Woodhead Publishing Radiation Dosimetry Phosphors provides an overview of the synthesis, properties and applications of materials used for radiation dosimetry and reviews the most appropriate phosphor materials for each radiation dosimetry technique. The book describes the available phosphors used commercially for their applications in the medical field for dose measurements. Although radiation dosimetry phosphors are commercially available, continuous efforts have been made by the worldwide research community to develop new materials or improve already existing materials used in different areas with low or high levels of radiation. Moreover, researchers are still working on developing dosimetric phosphors for OSL, ML, LL and RPL dosimetry. This book provides an overall view of the phosphors available, low cost synthesis methods, mechanisms involved, emerging trends and new challenges for the development of emerging materials for radiation dosimetry. It is suitable for those working in academia and R&D laboratories in the discipline of materials science and engineering, along with practitioners working in radiation and dosimetry. Provides the fundamental concepts, historical context and review of current phosphors available for radiation dosimetry Reviews low-cost material methods to synthesize and characterize rare earth doped inorganic phosphors for different kinds of radiation dosimetry techniques Discusses key barriers and potential solutions for enabling commercial realization phosphors for radiation dosimetry applications*

# Optical Bleach For Dosimetry in Al<sub>2</sub>O<sub>3</sub>:C Base On Optically Stimulated Luminescence Technique

Dosimetry Based on Thermally and  
Optically Stimulated Luminescence,  
Dissertation Submitted June 1997  
for the Ph.D.Degree at the Niels  
Bohr Institute, University of  
Copenhagen

World Congress on Medical Physics  
and Biomedical Engineering 2018  
June 3-8, 2018, Prague, Czech  
Republic (Vol.1)

*Springer This book (vol. 1) presents the proceedings of the IUPESM World Congress on Biomedical Engineering and Medical Physics, a triennially organized joint meeting of medical physicists, biomedical engineers and adjoining health care professionals. Besides the purely scientific and technological topics, the 2018 Congress will also focus on other aspects of professional involvement in health care, such as education and training, accreditation and certification, health technology assessment and patient safety. The IUPESM meeting is an important forum for medical physicists and biomedical engineers in medicine and healthcare learn and share knowledge, and discuss the latest research outcomes and technological advancements as well as new ideas in both medical physics and biomedical engineering field.*

# Space Radiation Dosimetry

## An Optically Stimulated Luminescence Radiation Detector for Low-Earth Orbit

## Optically Stimulated Luminescence Dosimetry with NaCl Pellets

## Dosimetry for Prospective Applications

## Radiation Therapy Dosimetry

## A Practical Handbook

*CRC Press This comprehensive book covers the everyday use and underlying principles of radiation dosimeters used in radiation oncology clinics. It provides an up-to-date reference spanning the full range of current modalities with emphasis on practical know-how. The main audience is medical physicists, radiation oncology physics residents, and medical physics graduate students. The reader gains the necessary tools for determining which detector is best for a given application. Dosimetry of cutting edge techniques from radiosurgery to MRI-guided systems to small fields and proton therapy are all addressed. Main topics include fundamentals of radiation dosimeters, brachytherapy and external beam radiation therapy dosimetry, and dosimetry of imaging modalities. Comprised of 30 chapters authored by leading experts in the medical physics community, the book: Covers the basic principles and practical use of radiation dosimeters in radiation oncology clinics across the full range of current modalities. Focuses on providing practical guidance for those using these detectors in the clinic. Explains which detector is more suitable for a particular application. Discusses the state of the art in radiotherapy approaches, from radiosurgery and MR-guided systems to advanced range verification techniques in proton therapy. Gives critical comparisons of dosimeters for photon, electron, and proton therapies.*

# Scintillation Dosimetry

*CRC Press Scintillation Dosimetry delivers a comprehensive introduction to plastic scintillation dosimetry, covering everything from basic radiation dosimetry concepts to plastic scintillating fiber optics. Comprised of chapters authored by leading experts in the medical physics community, the book: Discusses a broad range of technical implementations, from point source dosimetry scaling to 3D-volumetric and 4D-scintillation dosimetry Addresses a wide scope of clinical applications, from machine quality assurance to small-field and in vivo dosimetry Examines related optical techniques, such as optically stimulated luminescence (OSL) or Čerenkov luminescence Thus, Scintillation Dosimetry provides an authoritative reference for detailed, state-of-the-art information on plastic scintillation dosimetry and its use in the field of radiation dosimetry.*

## Development and Characterization of Remote Radiation Dosimetry Systems Using Optically Stimulated Luminescence of Al<sub>2</sub>O<sub>3</sub>:C and KBr:Eu

## Characterization of a Commercial Optically Stimulated Luminescence Dosimetry System

*There is a need to better understand the risks of low level radiation dose in medical diagnostic procedures and ensure that dose measurements are accurate and traceable to National Standards. Users of instruments typically calibrate their dosimeters with one type of radiation beam with a specific photon energy spectrum (referred to as beam quality) and then may use these dosimeters to measure radiation in other types of radiation beam qualities over a different range of photon energies. This is not a problem if the dosimeter response is relatively constant for a broad range of photon energies. However, the response of the optically stimulated luminescent (OSL) dosimeters studied in this work have a relatively strong energy dependence for photons with energies less than 100 keV. Moreover, since this work focused on measuring doses in diagnostic units only, where the mean photon energies are below 100 keV, using a single calibration based on an 80 kVp beam*

quality as provided by the vendor of the system could result in inaccurate dose measurements. To address this hypothesis, as part of this work, the system was calibrated independently using other beam qualities that better match those of diagnostic units including: RQR50, RQR60, M60, M80 and M100 (Lamperti & O'Brien, 2001), available at the National Institute of Standards and Technology (NIST). A comparison was then made of the air kerma measured by the OSL system using both the vendor's OSL reader calibration and the independent calibration implemented in this work. This comparison shows that when measuring air kerma in x-ray beams with beam qualities that have energy spectra different than the energy spectra of the x-ray beam in which the vendor prepared their calibration set (80 kVp x-ray beam), significant differences of up to 20% are observed. Because of this comparison, a set of beam quality correction factors (BQCF) were developed that allows correcting the air kerma values measured with the vendor's calibrated OSL system, to account for the differences in energy spectra in the air kerma measurement for different beam qualities and ensuring traceability to the national standard for air kerma.

## Dosimetry with Ionization Chambers and Optically Stimulated Luminescence Detectors in Magnetic Fields

## Evaluating Eye Lens Dose for Interventional Radiologists Using Optically Stimulated Luminescence Dosimetry in a Clinical Environment

## Theory of Thermoluminescence and Related Phenomena

World Scientific In this book, the authors give an up-to-date account of thermoluminescence (TL) and other thermally stimulated phenomena. Although most recent experimental results of TL in different materials are described in some detail, the main emphasis in the present book is on general processes, and the approach is more theoretical. Thus the details of the possible processes which can

take place during the excitation of the sample, and during its heating, are carefully analysed. The methods for analysing TL glow curves are critically discussed, and recommendations as to their application are made. Also discussed is the expected behavior of these phenomena as functions of the experimental parameters, for example, dose of excitation. The consequences of the main applications of TL (for example, radiation dosimetry) are also discussed in detail as are the similarities and dissimilarities of other thermally stimulated phenomena, and the simultaneous measurements of the latter and TL.

## Radiation Effects in Glasses for Intrinsic Optical Fibre Radiation Dosimetry

An optical fibre device has been developed for the purpose of detecting ionising radiation using optically stimulated luminescence. Characterisation of glass materials has been performed, after which optical fibres were fabricated for experiments to demonstrate sensing of ionising radiation. Fluoride phosphate glass was tested for its capability to sense ionising radiation, primarily using the mechanism of optically stimulated luminescence. The characteristics of the material were determined using a combination of spectroscopy, and thermally and optically stimulated luminescence tests. The sensitivity to ionising radiation was improved by introducing dopant ions into the glass; doping of fluoride phosphate glass with  $Tb^{3+}$  was found to increase the intensity of the optically stimulated luminescence response by an order of magnitude, from  $7.56 \times 10^6$  counts/g/Gy to  $100.7 \times 10^6$  counts/g/Gy. Optical fibres were fabricated from fluoride phosphate glass using the extrusion method for fibre preform manufacture. The fabrication process was optimised in each of the extrusion, preform processing and fibre drawing stages to achieve optical fibres with loss of between 0.5 - 1 dB/m for undoped fibres, and between 1 - 4 dB/m for  $Tb^{3+}$ -doped fibres. Optical fibres were used for ionising radiation sensing experiments, where the optically stimulated luminescence response was measured following both beta and X-ray irradiation. Following a dose of  $14.6 \pm 0.5$  Gy, optically stimulated luminescence signals were observable using optical fibre lengths of up to 2.6 m, with an integrated OSL intensity of  $44.1 \pm 13.0$  counts. Silica glass was also tested as an alternative material to perform optical fibre measurements using optically stimulated luminescence. The material was characterised and optical fibres were fabricated with a loss of 0.5 dB/m. Following a dose of  $15.5 \pm 0.5$  Gy, optically stimulated luminescence signals were observable using optical fibre lengths of up to 8.6 m, with an integrated OSL intensity of  $385.7 \pm 43.4$  counts.

# Khan's The Physics of Radiation Therapy

*Lippincott Williams & Wilkins Preceded by The physics of radiation therapy / Faiz M. Khan. 4th ed. c2010.*

Time-resolved Optically Stimulated Luminescence of Al<sub>2</sub>O<sub>3</sub>:C for Ion Beam Therapy Dosimetry

Image Reconstruction Algorithm for Optically Stimulated Luminescence 2D Dosimetry Using Laser-scanned Al<sub>2</sub>O<sub>3</sub>:C and Al<sub>2</sub>O<sub>3</sub>:C, Mg Films

Development of Optically Stimulated Luminescence Techniques Using Natural Minerals and Ceramics, and Their Application to Retrospective Dosimetry

Commissioning of an Optically Stimulated Luminescence

# Dosimetry (OSLD) System for in Vivo Dosimetry

*"A commercial OSL dosimetry system was investigated for passive in vivo dosimetry in radiation therapy. Al<sub>2</sub>O<sub>3</sub>:C OSLDs have been characterized by various authors and researchers, however an AAPM protocol for its clinical use is still in progress. In this work, a system of nanoDots with the microStar reader (Landauer Inc.) was tested using typical radiotherapy beams in our clinic. The goal was to fully characterize the system and determine all the necessary correction factors for accurate patient dose measurements. The results demonstrate that our OSLD system is a valid alternative to already established in vivo dosimetry methods in our clinic." --*

## A Study of Optically Stimulated Luminescence in Al<sub>2</sub>O<sub>3</sub> Fibers for the Development of a Real-time, Fiber Optic Dosimetry System

### Characterization of the Optically Stimulated Luminescence Properties of Doped-SiO<sub>2</sub> as an Alternative to Thermoluminescence Dosimetry

### Luminescence

### Data Analysis and Modeling Using R

*Springer Nature This book covers applications of R to the general discipline of radiation dosimetry and to the specific areas of luminescence dosimetry, luminescence dating, and radiation protection dosimetry. It features more than 90 detailed worked examples of R code fully integrated into the text, with extensive annotations. The book shows how researchers can use available R packages to*

*analyze their experimental data, and how to extract the various parameters describing mathematically the luminescence signals. In each chapter, the theory behind the subject is summarized, and references are given from the literature, so that researchers can look up the details of the theory and the relevant experiments. Several chapters are dedicated to Monte Carlo methods, which are used to simulate the luminescence processes during the irradiation, heating, and optical stimulation of solids, for a wide variety of materials. This book will be useful to those who use the tools of luminescence dosimetry, including physicists, geologists, archaeologists, and for all researchers who use radiation in their research.*

## Encyclopedia of Geoarchaeology

*Springer Geoarchaeology is the archaeological subfield that focuses on archaeological information retrieval and problem solving utilizing the methods of geological investigation. Archaeological recovery and analysis are already geoarchaeological in the most fundamental sense because buried remains are contained within and removed from an essentially geological context. Yet geoarchaeological research goes beyond this simple relationship and attempts to build collaborative links between specialists in archaeology and the earth sciences to produce new knowledge about past human behavior using the technical information and methods of the geosciences. The principal goals of geoarchaeology lie in understanding the relationships between humans and their environment. These goals include (1) how cultures adjust to their ecosystem through time, (2) what earth science factors were related to the evolutionary emergence of humankind, and (3) which methodological tools involving analysis of sediments and landforms, documentation and explanation of change in buried materials, and measurement of time will allow access to new aspects of the past. This encyclopedia defines terms, introduces problems, describes techniques, and discusses theory and strategy, all in a format designed to make specialized details accessible to the public as well as practitioners. It covers subjects in environmental archaeology, dating, materials analysis, and paleoecology, all of which represent different sources of specialist knowledge that must be shared in order to reconstruct, analyze, and explain the record of the human past. It will not specifically cover sites, civilizations, and ancient cultures, etc., that are better described in other encyclopedias of world archaeology. The Editor Allan S. Gilbert is Professor of Anthropology at Fordham University in the Bronx, New York. He holds a B.A. from Rutgers University, and his M.A., M.Phil., and Ph.D. were earned at Columbia University. His areas of research interest include the Near East (late prehistory and early historic periods) as well as the Middle Atlantic region of the U.S. (historical archaeology). His specializations are in archaeozoology of the Near East and geoarchaeology, especially mineralogy and compositional analysis of pottery and building materials. Publications have covered a range of subjects, including ancient pastoralism, faunal quantification, skeletal microanatomy, brick geochemistry, and two co-edited volumes on the marine geology and geoarchaeology of the Black Sea basin.*

# Basic Characteristics of Laser Heating in Thermoluminescence and of Laser-Stimulated Luminescence

*This report summarizes the work on laser-stimulable luminescence. The effort emphasized three aspects: 1. Investigation of basic laser-stimulated luminescence phenomena such as laser-heated thermoluminescence for radiation dosimetry and optical (non-thermal) stimulated luminescence for potential application in radiation imaging and personnel dosimetry. 2. Graduate student training and interaction with guest scientists. 3. Technology transfer to U.S. industry. Keywords: Thermoluminescence, Thermoluminescence dosimetry, Laser heating, Heat transfer, Gaussian beam, Optically stimulated luminescence, Dosimetry, Radiography. (jhd).*

## Questions and Answers on Thermoluminescence (TL) and Optically Stimulated Luminescence (OSL)

*World Scientific Publishing Company Currently, thermoluminescence (TL) and optically stimulated luminescence (OSL) are the main techniques for studying the luminescence properties of several materials, mainly insulators called phosphors. Frequently, however, students and experts alike need to clarify some concepts related to the effects and defects present in the radiation interaction with solids generated by these phenomena. In this book, a series of questions and corresponding answers give a clearer explanation about the concepts, theory and models related to TL and OSL, including applications in important related areas. Students, researchers and teachers will find this book a good guide for understanding TL and OSL as methods for studying the nature of luminescent solids. It provides a quick way for clearing doubts in the concepts and terminology concerning OSL and TL, as it is intended to answer many questions which can be encountered in practical applications.*

## Practical Radiation Oncology

## Physics

# A Companion to Gunderson & Tepper's Clinical Radiation Oncology

*Elsevier Health Sciences* Perfect for radiation oncologists, medical physicists, and residents in both fields, *Practical Radiation Oncology Physics* provides a concise and practical summary of the current practice standards in therapeutic medical physics. A companion to the fourth edition of *Clinical Radiation Oncology*, by Drs. Leonard Gunderson and Joel Tepper, this indispensable guide helps you ensure a current, state-of-the-art clinical practice. Covers key topics such as relative and in-vivo dosimetry, imaging and clinical imaging, stereotactic body radiation therapy, and brachytherapy. Describes technical aspects a.

## Radiation Oncology Physics

# A Handbook for Teachers and Students

*IAEA* This publication is aimed at students and teachers involved in teaching programmes in field of medical radiation physics, and it covers the basic medical physics knowledge required in the form of a syllabus for modern radiation oncology. The information will be useful to those preparing for professional certification exams in radiation oncology, medical physics, dosimetry or radiotherapy technology.

# Thermoluminescence Dosimetry Materials

## Properties and Uses

## Feasibility Studies of Thin

# AL<sub>2</sub>O<sub>3</sub>:C Optically Stimulated Luminescence Dosimeters and Commercially Available OneDose<sup>™</sup> Dosimeters in Radiotherapy Dosimetry

## Practical Radiation Oncology

*Springer Nature This book addresses the most relevant aspects of radiation oncology in terms of technical integrity, dose parameters, machine and software specifications, as well as regulatory requirements. Radiation oncology is a unique field that combines physics and biology. As a result, it has not only a clinical aspect, but also a physics aspect and biology aspect, all three of which are inter-related and critical to optimal radiation treatment planning. In addition, radiation oncology involves a host of machines/software. One needs to have a firm command of these machines and their specifications to deliver comprehensive treatment. However, this information is not readily available, which poses serious challenges for students learning the planning aspect of radiation therapy. In response, this book compiles these relevant aspects in a single source. Radiation oncology is a dynamic field, and is continuously evolving. However, tracking down the latest findings is both difficult and time-consuming. Consequently, the book also comprehensively covers the most important trials. Offering an essential ready reference work, it represents a value asset for all radiation oncology practitioners, trainees and students.*

## Clinical 3D Dosimetry in Modern Radiation Therapy

*CRC Press This book provides a first comprehensive summary of the basic principles, instrumentation, methods, and clinical applications of three-dimensional dosimetry in modern radiation therapy treatment. The presentation reflects the major growth in the field as a result of the widespread use of more sophisticated radiotherapy approaches such as intensity-modulated radiation therapy and proton therapy, which require new 3D dosimetric techniques to determine very accurately the dose distribution. It is intended as an essential guide for those involved in the design and implementation of new treatment technology and its application in advanced*

*radiation therapy, and will enable these readers to select the most suitable equipment and methods for their application. Chapters include numerical data, examples, and case studies.*