

SECOND EDITION

# Semiconductor Counters for Nuclear Radiations

G. DEARNALEY  
D.C. NORTHROP



# Semiconductor Counters For Nuclear 2nd Edition

**CO Houle**



## **Semiconductor Counters For Nuclear 2nd Edition:**

*Fundamentals of Nuclear Science and Engineering Second Edition* J. Kenneth Shultis, Richard E. Faw, 2007-11-01 Since the publication of the bestselling first edition there have been numerous advances in the field of nuclear science In medicine accelerator based teletherapy and electron beam therapy have become standard New demands in national security have stimulated major advances in nuclear instrumentation An ideal introduction to the fundamentals of nuclear science and engineering this book presents the basic nuclear science needed to understand and quantify an extensive range of nuclear phenomena New to the Second Edition A chapter on radiation detection by Douglas McGregor Up to date coverage of radiation hazards reactor designs and medical applications Flexible organization of material that allows for quick reference This edition also takes an in depth look at particle accelerators nuclear fusion reactions and devices and nuclear technology in medical diagnostics and treatment In addition the author discusses applications such as the direct conversion of nuclear energy into electricity The breadth of coverage is unparalleled ranging from the theory and design characteristics of nuclear reactors to the identification of biological risks associated with ionizing radiation All topics are supplemented with extensive nuclear data compilations to perform a wealth of calculations Providing extensive coverage of physics nuclear science and nuclear technology of all types this up to date second edition of *Fundamentals of Nuclear Science and Engineering* is a key reference for any physicists or engineer

*Fundamentals of Nuclear Science and Engineering Third Edition* J. Kenneth Shultis, Richard E. Faw, 2016-11-30 *Fundamentals of Nuclear Science and Engineering Third Edition* presents the nuclear science concepts needed to understand and quantify the whole range of nuclear phenomena Noted for its accessible level and approach the Third Edition of this long time bestselling textbook provides overviews of nuclear physics nuclear power medicine propulsion and radiation detection Its flexible organization allows for use with Nuclear Engineering majors and those in other disciplines The Third Edition features updated coverage of the newest nuclear reactor designs fusion reactors radiation health risks and expanded discussion of basic reactor physics with added examples A complete Solutions Manual and figure slides for classroom projection are available for instructors adopting the text

**Radiation Detection** Douglas McGregor, J. Kenneth Shultis, 2020-08-19 *Radiation Detection Concepts Methods and Devices* provides a modern overview of radiation detection devices and radiation measurement methods The book topics have been selected on the basis of the authors many years of experience designing radiation detectors and teaching radiation detection and measurement in a classroom environment This book is designed to give the reader more than a glimpse at radiation detection devices and a few packaged equations Rather it seeks to provide an understanding that allows the reader to choose the appropriate detection technology for a particular application to design detectors and to competently perform radiation measurements The authors describe assumptions used to derive frequently encountered equations used in radiation detection and measurement thereby providing insight when and when not to apply the many approaches used in different aspects of radiation detection Detailed

in many of the chapters are specific aspects of radiation detectors including comprehensive reviews of the historical development and current state of each topic. Such a review necessarily entails citations to many of the important discoveries providing a resource to find quickly additional and more detailed information. This book generally has five main themes: Physics and Electrostatics needed to Design Radiation Detectors; Properties and Design of Common Radiation Detectors; Description and Modeling of the Different Types of Radiation Detectors; Radiation Measurements and Subsequent Analysis; Introductory Electronics Used for Radiation Detectors. Topics covered include atomic and nuclear physics; radiation interactions; sources of radiation and background radiation. Detector operation is addressed with chapters on radiation counting statistics; radiation source and detector effects; electrostatics for signal generation; solid state and semiconductor physics; background radiations and radiation counting and spectroscopy. Detectors for gamma rays, charged particles and neutrons are detailed in chapters on gas filled scintillator, semiconductor, thermoluminescence and optically stimulated luminescence, photographic film and a variety of other detection devices.

Semiconductor Devices and Integrated Electronics A. G. Milnes, 2012-12-06. For some time there has been a need for a semiconductor device book that carries diode and transistor theory beyond an introductory level and yet has space to touch on a wider range of semiconductor device principles and applications. Such topics are covered in specialized monographs numbering many hundreds but the voluminous nature of this literature limits access for students. This book is the outcome of attempts to develop a broad course on devices and integrated electronics for university students at about senior year level. The educational prerequisites are an introductory course in semiconductor junction and transistor concepts and a course on analog and digital circuits that has introduced the concepts of rectification, amplification, oscillators, modulation and logic and Switching circuits. The book should also be of value to professional engineers and physicists because of both the information included and the detailed guide to the literature given by the references. The aim has been to bring some measure of order into the subject area examined and to provide a basic structure from which teachers may develop themes that are of most interest to students and themselves. Semiconductor devices and integrated circuits are reviewed and fundamental factors that control power levels, frequency, speed, size and cost are discussed. The text also briefly mentions how devices are used and presents circuits and comments on representative applications. Thus the book seeks a balance between the extremes of device physics and circuit design.

Silicon Solid State Devices and Radiation Detection Claude Leroy, Pier-Giorgio Rancoita, 2012. This book addresses the fundamental principles of interaction between radiation and matter, the principles of working and the operation of particle detectors based on silicon solid state devices. It covers a broad scope with respect to the fields of application of radiation detectors based on silicon solid state devices from low to high energy physics experiments including in outer space and in the medical environment. This book covers state of the art detection techniques in the use of radiation detectors based on silicon solid state devices and their readout electronics including the latest developments on pixelated silicon radiation

detector and their application The content and coverage of the book benefit from the extensive experience of the two authors who have made significant contributions as researchers as well as in teaching physics students in various universities

Principles of Radiation Interaction in Matter and Detection (4th Edition) Claude Leroy, 2015-12-17 The fourth edition of this book has been widely revised It includes additional chapters and some sections are complemented with either new ones or an extension of their content In this latest edition a complete treatment of the physics and properties of semiconductors is presented covering transport phenomena in semiconductors scattering mechanisms radiation effects and displacement damages Furthermore this edition presents a comprehensive treatment of the Coulomb scattering on screened nuclear potentials resulting from electrons protons light and heavy ions ranging from very low up to ultra relativistic kinetic energies and allowing one to derive the corresponding NIEL non ionizing energy loss doses deposited in any material The contents are organized into two parts Chapters 1 to 7 cover Particle Interactions and Displacement Damage while the remaining chapters focus on Radiation Environments and Particle Detection This book can serve as reference for graduate students and final year undergraduates and also as supplement for courses in particle astroparticle space physics and instrumentation A section of the book is directed toward courses in medical physics Researchers in experimental particle physics at low medium and high energy who are dealing with instrumentation will also find the book useful

*Principles Of Radiation Interaction In Matter And Detection (3rd Edition)* Claude Leroy, Pier-giorgio Rancoita, 2011-09-23 This book like the first and second editions addresses the fundamental principles of interaction between radiation and matter and the principles of particle detection and detectors in a wide scope of fields from low to high energy including space physics and medical environment It provides abundant information about the processes of electromagnetic and hadronic energy deposition in matter detecting systems performance of detectors and their optimization The third edition includes additional material covering for instance mechanisms of energy loss like the inverse Compton scattering corrections due to the Landau Pomeranchuk Migdal effect an extended relativistic treatment of nucleus nucleus screened Coulomb scattering and transport of charged particles inside the heliosphere Furthermore the displacement damage NIEL in semiconductors has been revisited to account for recent experimental data and more comprehensive comparisons with results previously obtained This book will be of great use to graduate students and final year undergraduates as a reference and supplement for courses in particle astroparticle space physics and instrumentation A part of the book is directed toward courses in medical physics The book can also be used by researchers in experimental particle physics at low medium and high energy who are dealing with instrumentation

**Principles of Radiation Interaction in Matter and Detection** Claude Leroy, 2012 This book like the first and second editions addresses the fundamental principles of interaction between radiation and matter and the principles of particle detection and detectors in a wide scope of fields from low to high energy including space physics and medical environment It provides abundant information about the processes of electromagnetic and hadronic energy deposition in matter detecting

systems performance of detectors and their optimization The third edition includes additional material covering for instance mechanisms of energy loss like the inverse Compton scattering corrections due to the Landau-Pomeranchuk-Migdal effect an extended relativistic treatment of nucleus-screened Coulomb scattering and transport of charged particles inside the heliosphere Furthermore the displacement damage NIEL in semiconductors has been revisited to account for recent experimental data and more comprehensive comparisons with results previously obtained This book will be of great use to graduate students and final year undergraduates as a reference and supplement for courses in particle astrophysics space physics and instrumentation A part of the book is directed toward courses in medical physics The book can also be used by researchers in experimental particle physics at low medium and high energy who are dealing with instrumentation

**Lithium-Drifted Germanium Detectors: Their Fabrication and Use** I. C. Brownridge, 2012-12-06 A lithium drifted germanium detector is a semiconductor device which operates at liquid nitrogen temperature and is used for detection of nuclear radiation mostly gamma ray The detection occurs when the  $\gamma$  ray undergoes an interaction in the intrinsic or I region of the semiconductor The interaction results in the production of charge carriers which are swept out by an electric field This is accomplished by reverse biasing the detector with approximately 100 V/mm of intrinsic material The total amount of charge swept out is proportional to the energy dissipated in the intrinsic region This may include the total energy of the photon but generally somewhat less The Ge-Li device is a semiconductor p-n device with a very large intrinsic region between the positive carrier region and the negative carrier region P-I-N The fabrication of this device consists of three major steps the diffusion of the lithium into the p-type germanium to give an n-type surface region the drifting process to obtain the intrinsic region as deeply as possible and the surface preparation There are numerous procedures for the various steps as well as criteria for material selection and the preparation of the materials

**Treatise on Heavy-Ion Science** D.A. Bromley, 2013-04-17 *Radiochemical Methods in Analysis* D. Coomber, 2012-12-06 The aim of this book is to give an account of the principal radiochemical methods used in chemical analysis It is assumed that the reader already has some background knowledge of radioactivity available from several general textbooks For this reason some subjects e.g. the fundamentals of radioactivity the properties of radiation statistics of counting procedures the precautions needed in working with radioactive materials which could have occupied half the text are not considered in detail The different aspects of radiochemical analysis have been covered by specialized books and reviews e.g. on activation analysis gamma spectrometry radiometric titrations A good deal of information is in the form of reports of meetings and symposia and liquid scintillation counting for instance has been mainly covered in this way There are also a large number of journals It is therefore hoped that this book will help fill the gap between the introductory texts and the specialized sources many of which are referred to in the chapter references The first three chapters in the present volume deal with the methods of measurement of radioactive nuclides Chapter I gives a general account of detection and measurement techniques The next two chapters are devoted to

two specialized techniques gamma ray spectrometry and liquid scintillation counting      **Applied Gamma-Ray Spectrometry** C. E. Crouthamel, F. Adams, R. Dams, 2013-10-22 Applied Gamma Ray Spectrometry covers real life application of the gamma ray and the devices used in their experimental studies This book is organized into 9 chapters and starts with discussions of the various decay processes the possible interaction mechanisms of gamma radiation with matter and the intrinsic and extrinsic variables which affect the observed gamma ray and X ray spectra The subsequent chapters deal with the properties and fabrication of scintillation detectors semiconductor detectors and proportional gas counters These chapters present some of the most widely utilized applications of these detectors with a particular emphasis to the activation analysis These topics are followed by reviews of the description of basic equipment such as amplifiers analyzers special spectrometer arrangements and detector shielding Other chapters describe energy and time resolution and quantitative calibration The quantitative and qualitative interpretation of the spectra is also explained along with the calibration of the detectors The last chapter considers the analytical applications of gamma ray and X ray spectrometry in tracer studies activation analysis fission product studies and X ray fluorescence analysis This book will be of value to analytical chemists and analytical chemistry researchers      **Treatise on Analytical Chemistry, Part 1 Volume 14** Izaak Maurits Kolthoff, Philip J. Elving, V. Krivan, 1986 An updated volume in this provides concise critical systematic treatments of important topics designed to stimulate fundamental research in pure and applied analytical chemistry as well as the scientific and instrumental fundamentals of analytical methods      **Radiation Detection and Measurement** Glenn F. Knoll, 2010-08-16 Known for its comprehensive coverage and up to date literature citations this classic text provides students and instructors with the most complete coverage available of radiation detection and measurement Over the decade that has passed since the publication of the 3rd edition technical developments continue to enhance the instruments and techniques available for the detection and spectroscopy of ionizing radiation The Fourth Edition of this invaluable resource incorporates the latest developments and cutting edge technologies to make this the most up to date guide to the field available Covers many new materials that are emerging as scintillators that can achieve energy resolution that is better by a factor of two compared with traditional materials Presents new material on ROC curves micropattern gas detectors new sensors for scintillation light thick film semiconductors and digital techniques in detector pulse processing Includes updated discussions on TLDs neutron detectors cryogenic spectrometers radiation backgrounds and the VME instrumentation standard      *The Publishers' Trade List Annual* ,1967      **Nuclear Science Abstracts** ,1975 NSA is a comprehensive collection of international nuclear science and technology literature for the period 1948 through 1976 pre dating the prestigious INIS database which began in 1970 NSA existed as a printed product Volumes 1 33 initially created by DOE s predecessor the U S Atomic Energy Commission AEC NSA includes citations to scientific and technical reports from the AEC the U S Energy Research and Development Administration and its contractors plus other agencies and international organizations

universities and industrial and research organizations References to books conference proceedings papers patents dissertations engineering drawings and journal articles from worldwide sources are also included Abstracts and full text are provided if available      **Proceedings of the Physical Society, Volume 89** ,1966      **Proceedings of the Conference on Slow-Neutron-Capture Gamma-Ray Spectroscopy** F. E. Throw,1968      *Handbook of Drug Metabolism, Third Edition* Paul G. Pearson,Larry C. Wienkers,2016-04-26 The second edition of a bestseller this book presents the latest innovative research methods that help break new ground by applying patterns reuse and design science to research The book relies on familiar patterns to provide the solid fundamentals of various research philosophies and techniques as touchstones that demonstrate how to innovate research methods Filled with practical examples of applying patterns to IT research with an emphasis on reusing research activities to save time and money this book describes design science research in relation to other information systems research paradigms such as positivist and interpretivist research      *Radioisotope Experiments in Physics, Chemistry and Biology* J. B. Dance,1973



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