



X Ray Optics

Eberhard Spiller



X Ray Optics:

X-Ray Optics Yuri Shvyd'ko, 2004-06-25 The generation of radiation with well defined frequency and wavelength and the ability to precisely determine these quantities are of fundamental importance in physics and other natural sciences Monochromatic radiation enables both very accurate structure determinations and studies of the dynamics of living and non living matter It is crucial for the realization of standards of time and length for the determination of fundamental constants and for many other aspects of basic research Bragg backscattering from perfect crystals is a tool for creating manipulating and analyzing x rays with highest spectral purity It has the unique feature of selecting x rays with narrow spectral bandwidth This book describes the theoretical foundations and principles of x ray crystal optics with high spectral resolution Various experimental studies and applications are presented and the author also addresses the development of instrumentation such as high resolution x ray monochromators analyzers wavelength meters resonators and interferometers The book will be a valuable source of information for all students and researchers working in the field of x ray optics

An Introduction to X-Ray Physics, Optics, and Applications Carolyn A. MacDonald, 2017-06-13 In this book Carolyn A MacDonald provides a comprehensive introduction to the physics of a wide range of x ray applications optics and analysis tools Theory is applied to practical considerations of optics and applications ranging from astronomy to medical imaging and materials analysis Emphasizing common physical concepts that underpin diverse phenomena and applications of x ray physics the book opens with a look at nuclear medicine motivating further investigations into scattering detection and noise statistics The second section explores topics in x ray generation including characteristic emission x ray fluorescence analysis bremsstrahlung emission and synchrotron and laser sources The third section details the main forms of interaction including the physics of photoelectric absorption coherent and Compton scattering diffraction and refractive reflective and diffractive optics Applications in this section include x ray spectroscopy crystallography and dose and contrast in radiography A bibliography is included at the end of every chapter and solutions to chapter problems are provided in the appendix Based on a course for advanced undergraduates and graduate students in physics and related sciences and also intended for researchers An Introduction to X Ray Physics Optics and Applications offers a thorough survey of the physics of x ray generation and of interaction with materials Common aspects of diverse phenomena emphasized Theoretical development tied to practical applications Suitable for advanced undergraduate and graduate students in physics or related sciences as well as researchers Examples and problems include applications drawn from medicine astronomy and materials analysis Detailed solutions are provided for all examples and problems

An Introduction to X-ray Physics, Optics, and Applications Carolyn Ann MacDonald, 2017 In this book Carolyn A MacDonald provides a comprehensive introduction to the physics of a wide range of x ray applications optics and analysis tools Theory is applied to practical considerations of optics and applications ranging from astronomy to medical imaging and materials analysis Emphasizing common physical concepts that

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Light and X-Ray Optics Emil Zolotoyabko, 2023-09-07 Contemporary optics is the foundation of many of today's technologies including various focusing and defocusing devices microscopies and imaging techniques Light and X ray Optics for Materials Scientists and Engineers offers a guide to basic concepts and provides an accessible framework for understanding this highly application relevant branch of science for materials scientists physicists chemists biologists and engineers trained in different disciplines The text links the fundamentals of optics to modern applications especially for promotion of nanotechnology and life science such as conventional near field confocal phase contrast microscopies and imaging schemes based on interference and diffraction phenomena Written by a noted expert and experienced instructor the book contains numerous worked examples throughout to help the reader gain a thorough understanding of the concepts and information presented The text covers a wide range of relevant topics including reflection refraction and focusing phenomena wave polarization and birefringence in crystals optics in negative materials metamaterials and photonic structures holography light and X ray interferometry extensive description of diffraction optics including dynamical X ray diffraction and more

X-ray Optics A. Authier, 1977

X-Ray Optics and X-Ray Microanalysis H. H. Pattee, V. E. Cosslett, Arne Engström, 2013-10-22 X ray Optics and X ray Microanalysis covers the proceedings of the Symposium on X ray Optics and X ray Microanalysis held at Stanford University on August 22-24 1962 The book focuses on X ray microscopy microradiography radiation and irradiation and X ray microanalysis The selection first offers information on the methods of X ray microscopy and X ray absorption microanalysis Discussions focus on X ray scanning microscopy contact microradiography point projection microscopy and total dry weight determinations The text then takes a look at X ray microanalysis in biology and medicine electron microscopic enlargements of X ray absorption micrographs and automation in microradiography The publication

examines the production of Fresnel zone plates for extreme ultraviolet and soft X radiation quantitative microradiographic studies of human epidermis and irradiation effect on total organic nerve cell material determined by integrating X ray absorption The manuscript then reviews the calculation of fluorescence excited by characteristic radiation in the X ray microanalyzer and the method for calculating the absorption correction in electron probe microanalysis The selection is a valuable reference for readers interested in X ray technology

Soft X-ray Optics Eberhard Spiller,1994 This text describes optics mainly in the 10 to 500 angstrom wavelength region These wavelengths are 50 to 100 times shorter than those for visible light and 50 to 100 times longer than the wavelengths of medical x rays or x ray diffraction from natural crystals There have been substantial advances during the last 20 years which one can see as an extension of optical technology to shorter wavelengths or as an extension of x ray diffraction to longer wavelengths Artificial diffracting structures like zone plates and multilayer mirrors are replacing the natural crystals of x ray diffraction Some of these structures can now be fabricated to have diffraction limited resolution The new possibilities are described in a simple tutorial way

Springer Handbook of Lasers and Optics Frank Träger,2012-05-05 This new edition features numerous updates and additions Especially 4 new chapters on Fiber Optics Integrated Optics Frequency Combs and Interferometry reflect the changes since the first edition In addition major complete updates for the chapters Optical Materials and Their Properties Optical Detectors Nanooptics and Optics far Beyond the Diffraction Limit Features Contains over 1000 two color illustrations Includes over 120 comprehensive tables with properties of optical materials and light sources Emphasizes physical concepts over extensive mathematical derivations Chapters with summaries detailed index Delivers a wealth of up to date references

Modern Developments in X-Ray and Neutron Optics Alexei Erko,Mourad Idir,Thomas Krist,Alan G. Michette,2008-04-14 This volume describes modern developments in reflective refractive and diffractive optics for short wavelength radiation It also covers recent theoretical approaches to modelling and ray tracing the x ray and neutron optical systems It is based on the joint research activities of specialists in x ray and neutron optics working together under the framework of the European Programme for Cooperation in Science and Technology COST Action P7 in the period 2002 2006

Design and Microfabrication of Novel X-ray Optics II Anatoly A. Snigirev,Derrick C. Mancini,2004 Proceedings of SPIE present the original research papers presented at SPIE conferences and other high quality conferences in the broad ranging fields of optics and photonics These books provide prompt access to the latest innovations in research and technology in their respective fields Proceedings of SPIE are among the most cited references in patent literature

Coherent X-Ray Optics David Paganin,2006-01-12 X ray optics is undergoing a renaissance which may be paralleled to that experienced by visible light optics following the invention of the laser The associated surge of activity in coherent x ray optics has been documented in this monograph the first of its type in the field

Handbook of Practical X-Ray Fluorescence Analysis Burkhard Beckhoff,Birgit Kanngießner,Norbert Langhoff,Reiner Wedell,Helmut Wolff,2007-05-18 X Ray fluorescence analysis is an

established technique for non destructive elemental materials analysis This book gives a user oriented practical guidance to the application of this method The book gives a survey of the theoretical fundamentals analytical instrumentation software for data processing various excitation regimes including grazing incidents and microfocus measurements quantitative analysis applications in routine and micro analysis mineralogy biology medicine criminal investigations archeology metallurgy abrasion microelectronics environmental air and water analysis This book is the bible of X Ray fluorescence analysis It gives the basic knowledge on this technique information on analytical equipment and guides the reader to the various applications It appeals to researchers analytically active engineers and advanced students

X-ray Optics for Astronomy Paul Gorenstein, Richard B. Hoover, Society of Photo-optical Instrumentation Engineers, 2002

X-Ray Spectrometry Kouichi Tsuji, Jasna Injuk, René Van Grieken, 2005-08-19 X Ray Spectrometry Recent Technological Advances covers the latest developments and areas of research in the methodological and instrumental aspects of x ray spectrometry Includes the most advanced and high tech aspects of the chemical analysis techniques based on x rays Introduces new types of X ray optics and X ray detectors covering history principles characteristics and future trends Written by internationally recognized scientists all of whom are eminent specialists in each of the sub fields Sections include X Ray Sources X Ray Optics X Ray Detectors Special Configurations New Computerization Methods New Applications This valuable book will assist all analytical chemists and other users of x ray spectrometry to fully exploit the capabilities of this set of powerful analytical tools and to further expand applications in such fields as material and environmental sciences medicine toxicology forensics archaeometry and many others

High Resolution Soft X-ray Optics Eberhard Spiller, 1982 *Encyclopedia of Optical and Photonic Engineering (Print) - Five Volume Set* Craig Hoffman, Ronald Driggers, 2015-09-22 The first edition of the Encyclopedia of Optical and Photonic Engineering provided a valuable reference concerning devices or systems that generate transmit measure or detect light and to a lesser degree the basic interaction of light and matter This Second Edition not only reflects the changes in optical and photonic engineering that have occurred since the first edition was published but also Boasts a wealth of new material expanding the encyclopedia s length by 25 percent Contains extensive updates with significant revisions made throughout the text Features contributions from engineers and scientists leading the fields of optics and photonics today With the addition of a second editor the Encyclopedia of Optical and Photonic Engineering Second Edition offers a balanced and up to date look at the fundamentals of a diverse portfolio of technologies and discoveries in areas ranging from x ray optics to photon entanglement and beyond This edition s release corresponds nicely with the United Nations General Assembly s declaration of 2015 as the International Year of Light working in tandem to raise awareness about light s important role in the modern world Also Available Online This Taylor E mail e reference taylorandfrancis.com International Tel 44 0 20 7017 6062 E mail online sales tandf.co.uk

X-ray Optics Design, Performance, and Applications Ali M. Khounsary, 1999

X-ray Optics, Instruments, and Missions, 1998

X-ray waveguide optics Sarah

Hoffmann-Urlaub,2017 Modern x ray sources and analysis techniques such as lens less imaging combined with phase retrieval algorithms allow for resolving structure sizes in the nanometer range For this purpose optics have to be employed ensuring small focal spot dimensions simultaneously with high photon densities Furthermore the wave front behind the optics is required to be smooth enabling for high resolution imaging Combining all these properties x ray waveguides are well suited to perform this task since the intensity distribution behind the guide is restricted in two dimensions serving as a secondary quasi point source without wave front aberrations showing also a high divergence suitable for resolving fine features Importantly the radiation provided by the waveguide reveals a high degree of coherence required by many imaging techniques The waveguide itself consists of an air filled channel embedded in a solid matrix typical materials are silicon germanium or quartz While the entrance area is nano sized the channel length is in the millimeter range this way posing challenges to fabricate high aspect ratio geometries Since the functioning of x ray waveguides is based on the total reflection at small incident angles the surface roughness of the channel walls must be as low as possible to avoid scattering and hence loss of intensity To fulfill these demanding conditions a process scheme involving spin coating electron beam lithography wet development reactive ion etching and wafer bonding is optimized within this work To gain deeper insights into the principle of wave guiding finite difference simulations are performed also opening access for advanced design considerations such as gratings tapered and curved channels or beamsplitters enabling for constructing novel x ray tools as for example time delay devices or interferometers Waveguides in all geometries are tested at synchrotron sources accomplishing new benchmarks in x ray optical performance Here the x ray beam leaving the channel propagates out to a pixel array detector in the far field region From the recorded data the intensity distribution in the near field directly behind the waveguide is reconstructed revealing an outstanding agreement with the simulations and electron micrographs Since the radiation field of the waveguide is well characterized and also tunable to meet the requirements of both the measurement setup and the sample they are suited of a broad field of applications in coherent x ray imaging

Nonlinear Optics, Quantum Optics, and Ultrafast

Phenomena with X-Rays Bernhard Adams,2003-08-31 Nonlinear Optics Quantum Optics and Ultrafast Phenomena with X Rays is an introduction to cutting edge science that is beginning to emerge on state of the art synchrotron radiation facilities and will come to flourish with the x ray free electron lasers currently being planned It is intended for the use by scientists at synchrotron radiation facilities working with the combination of x rays and lasers and those preparing for the science at x ray free electron lasers In the past decade synchrotron radiation sources have experienced a tremendous increase in their brilliance and other figures of merit This progress driven strongly by the scientific applications is still going on and may actually be accelerating with the advent of x ray free electron lasers As a result a confluence of x ray and laser physics is taking place due to the increasing importance of laser concepts such as coherence and nonlinear optics to the x ray community and the importance of x ray optics to the laser generation of ultrashort pulses of x rays

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