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| 1. Record Nr. | UNIORUON00269619 |
| Autore | DASCAL, Marcelo |
| Titolo | La sémiologie de Leibniz / Marcelo Dascal |
| Pubbl/distr/stampa | Paris, : Aubier Montaigne, 1978 |
| ISBN | 27-00-70114-3 |
| Descrizione fisica | 272 p. ; 23 cm. |
| Disciplina | 193 |
| Soggetti | LEIBNIZ GOTTFRIED WILHELM SEMIOTICA |
| Lingua di pubblicazione | Francese |
| Formato | Materiale a stampa |
| Livello bibliografico | Monografia |
-
- | | |
|-------------------------|---|
| 2. Record Nr. | UNINA9910130865303321 |
| Autore | Als-Nielsen J (Jens), <1937-> |
| Titolo | Elements of modern X-ray physics / / Jens Als-Nielsen, Des McMorow |
| Pubbl/distr/stampa | Chichester, West Sussex, : John Wiley, 2011 |
| ISBN | 1-283-40566-0
9786613405661
1-118-30297-4
1-119-99731-3
1-119-99836-0 |
| Edizione | [2nd ed.] |
| Descrizione fisica | xii, 419 p. : ill. (some col.) |
| Classificazione | SCI077000 |
| Altri autori (Persone) | McMorowDes |
| Disciplina | 539.7/222 |
| Soggetti | X-rays
Electromagnetic waves |
| Lingua di pubblicazione | Inglese |
| Formato | Materiale a stampa |
| Livello bibliografico | Monografia |
| Note generali | Bibliographic Level Mode of Issuance: Monograph |
| Nota di bibliografia | Includes bibliographical references and index. |
| Nota di contenuto | Cover -- Title Page -- Copyright -- Contents -- Preface -- Preface to |

the first edition -- Acknowledgements from the first edition -- Notes on the use of this book -- Chapter 1 X-rays and their interaction with matter -- 1.1 X-rays: waves and photons -- 1.2 Scattering -- 1.3 Absorption -- 1.4 Refraction and reflection -- 1.5 Coherence -- 1.6 Magnetic interactions -- 1.7 Further reading -- Chapter 2 Sources -- 2.1 Early history and the X-ray tube -- 2.2 Introduction to synchrotron radiation -- 2.3 Synchrotron radiation from a circular arc -- 2.4 Undulator radiation -- 2.5 Wiggler radiation -- 2.6 Free-electron lasers -- 2.7 Compact light sources -- 2.8 Coherence volume and photon degeneracy -- 2.9 Further reading -- 2.10 Exercises -- Chapter 3 Refraction and reflection from interfaces -- 3.1 Refraction and phase shift in scattering -- 3.2 Refractive index and scattering length density -- 3.3 Refractive index including absorption -- 3.4 Snell's law and the Fresnel equations in the X-ray region -- 3.5 Reflection from a homogeneous slab -- 3.6 Specular reflection from multilayers -- 3.7 Reflectivity from a graded interface -- 3.8 Rough interfaces and surfaces -- 3.9 Examples of reflectivity studies -- 3.10 X-ray optics -- 3.11 Further reading -- 3.12 Exercises -- Chapter 4 Kinematical scattering I: non-crystalline materials -- 4.1 Two electrons -- 4.2 Scattering from an atom -- 4.3 Scattering from a molecule -- 4.4 Scattering from liquids and glasses -- 4.5 Small-angle X-ray scattering (SAXS) -- 4.6 Further reading -- 4.7 Exercises -- Chapter 5 Kinematical scattering II: crystalline order -- 5.1 Scattering from a crystal -- 5.2 Quasiperiodic structures -- 5.3 Crystal truncation rods -- 5.4 Lattice vibrations, the Debye-Waller factor and TDS -- 5.5 The measured intensity from a crystallite -- 5.6 Applications of kinematical diffraction. -- 5.7 Further reading -- 5.8 Exercises -- Chapter 6 Diffraction by perfect crystals -- 6.1 One atomic layer: reflection and transmission -- 6.2 Kinematical reflection from a few layers -- 6.3 Darwin theory and dynamical diffraction -- 6.4 The Darwin reflectivity curve -- 6.5 DuMond diagrams -- 6.6 Further reading -- 6.7 Exercises -- Chapter 7 Photoelectric absorption -- 7.1 X-ray absorption by an isolated atom -- 7.2 EXAFS and near-edge structure -- 7.3 X-ray dichroism -- 7.4 ARPES -- 7.5 Further reading -- 7.6 Exercises -- Chapter 8 Resonant scattering -- 8.1 The forced charged oscillator model -- 8.2 The atom as an assembly of oscillators -- 8.3 The Kramers-Kronig relations -- 8.4 Numerical estimate of f -- 8.5 Breakdown of Friedel's law and Bijvoet pairs -- 8.6 The phase problem in crystallography -- 8.7 Quantum mechanical description -- 8.8 Further reading -- 8.9 Exercises -- Chapter 9 Imaging -- 9.1 Introduction -- 9.2 Absorption contrast imaging -- 9.3 Phase contrast imaging -- 9.4 Coherent diffraction imaging -- 9.5 Holography -- 9.6 Further reading -- 9.7 Exercises -- A Scattering and absorption cross-sections -- B Classical electric dipole radiation -- C Quantization of the electromagnetic field -- D Gaussian statistics -- E Fourier transforms -- F Comparison of X-rays with neutrons -- G MATLAB® computer programs -- H Answers to exercises and hints -- Bibliography -- Index -- List of symbols -- EULA.

Sommario/riassunto

"Although the book has been written from the perspective of two physicists, we hope that it will be useful to the wider community of biologists, chemists, material scientists, etc., who work at synchrotron radiation facilities around the world"--