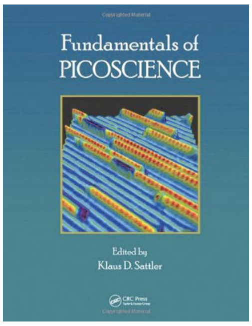

Fundamentals of Picoscience. Klaus D. Sattler (ed.). CRC Press, Taylor & Francis Group, Boca Raton, FL, USA. 2014. 756 pp. Price: US$ 179.95.

The book under review consists of 37 chapters which are further divided into 9 parts, namely Picoscale detection, Picoscale characterization, Picoscale imaging, Scanning probe microscopy, Electron orbitals, Atomic scale magnetism, Picowires, Picometer positioning and Picoscale devices. As the section headings suggest, the book proposes to cover the methods and materials at the picometer-size scale, which is the next size range below nanometre by three orders of magnitude.

Nanoscience has brought many new effects and inventions and is the basis for worldwide surge in nanotechnology. Currently, there are more than one million scientists involved in projects with nanoscale structures and materials. From the development of new quantum mechanical methods to far-reaching applications in the electronics industry and medical diagnostics, nanoscience has inspired numerous scientists and engineers towards new instrumental developments and inventions. 'Nano' has become the buzz word for extremely small even among the general public and many surprises can be expected in the future for structures at nanoscale.

We are entering an era of ever smaller and more efficient devices, which will rely on smaller designs and structures three orders below the nanometre scale. Do we already have instruments to probe below the nano-range? How can we develop new instruments to visualize and measure structures at the subnanometre size? Answers to these and other questions are given in this book.

One picometre is the length of a trillionth of a metre. Compared to a human cell of typically 10 μm, this is roughly ten million times smaller. In this state-of-the-art book, international scientists and researchers at the forefront of the field present the materials and methods used at the picoscale. They address the key challenges in developing new instrumentation and techniques to visualize and measure structures at this sub-nanometre level. The main purpose of this book is to help the young researchers understand the implications of picoscience, e.g. to understand how it is an extension of nanoscience; to determine which experimental technique to use in research, and to connect basic studies to the development of next-generation picoelectronic devices.

The book covers various approaches for detecting, characterizing and imaging at the picoscale. It then presents picoscale methods ranging from scanning tunnelling microscopy (STM) to spectroscopic approaches at sub-nanometre spatial and energy resolutions. It also covers novel picoscale structures and picometer positioning systems. The book concludes with picoscale device applications, including single-molecule electronics and optical computers. The authors of each chapter explain basic concepts, define technical terms, discuss theoretical background and give illustrations in reference to the context to explain the main purpose of the chapter.

In chapter 20, 'Attosecond imaging of molecular orbitals', the author makes use of high harmonic spectroscopy to probe the position of atoms within the molecule. This is where the new field of attosecond science shows much promise. An attosecond is an SI unit of time equal to 10^{-18} of a second (one quintillionth of a second). Lasers can now generate light pulses down to 100 attoseconds thereby enabling real-time measurements on ultrashort timescales that are inaccessible by any other methods.

It is not possible to review the contents of all 37 chapters of this book. The underlying principle of most of these chapters is the role played by the measurement techniques in the study of picoscale structures. In fact, these very techniques are used to explore matter at the nanoscale also. The invention of STM has brought a revolution in measurement techniques. When STM was invented, the main feature was to observe atomic configurations of surface atoms in real space. In chapter 22, the authors have illustrated how to study atomic-scale magnetism by spin-polarized scanning tunnelling microscopy. The understanding of magnetism at the ultimate atomic length scale is one of the current frontiers in solid state physics, which is the main purpose of this chapter.

The last six chapters of the book deserve special attention. These deal with Picoscale devices: Mirrors with sub-nanometre surface shape accuracy; Single molecule electronics; Single-atom transistors for light; Carbon-based zero-, one-, and two-dimensional materials for device application; Subnanometer characterization of nanoelectronic devices, and Chromophores for picoscale optical computers.

The salient features of this book are enumerated as follows:

- Provides details on all experimental techniques for picoscale studies, including atomic-scale optical and neutron holography, homodyne and heterodyne interferometry, digital holographic microscopy, single-atom STM, orbital-mediated tunnelling spectroscopy, electron energy loss spectroscopy, transmission electron microscopy and X-ray absorption fine structure.
- Explains how to determine the atomic structure of proteins and individual peptides through electron diffractive imaging and coherent X-ray diffraction imaging.
- Explores the future of picoelectronic devices, such as molecular electronic applications, NEM single-atom switches, a picomotor, single-photon quantum devices and single-photon gating systems.
- Includes introductions that explain basic concepts, defines technical terms, and gives theoretical approach to the basic phenomenon under discussion.

The editor has done excellent job in the selection of section themes and organizing the chapters in an appropriate manner. The literature survey is exhaustive and effort has been made to list references in full measure, giving titles of papers with page numbers and even month of publication wherever possible. There are hardly any typos that I could notice. I hope the research community will welcome this book, claimed by the publishers as the first of its kind at global level on fundamentals of picoscience.

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M.M.Barysheva, N. I. Chkhalo, A. E. Pestov, N. N. Salashchenko, M. N. Toropov, M. V. Zorina. Mirrors with a Sub-Nanometer Surface Shape Accuracy./ // Fundamentals of Picoscience/ Klaus D. Sattler (Ed.) â€" Taylor & Francis Group, 2013. â€" Đ Ñ€. 595âˆ'615. CRC Press 2013. Print ISBN: 978âˆ'1âˆ'4665âˆ'0509âˆ'4. eBook ISBN: 978âˆ'1âˆ'4665âˆ'0510âˆ'0. Đ¡ontact detail. Phone: +7 (831) 417âˆ'94âˆ'58. Taylor & Francis Group, 2014. â€" 754 p. Now ubiquitous in public discussions about cutting-edge science and technology, nanoscience has generated many advances and inventions, from the development of new quantum mechanical methods to far-reaching applications in electronics and medical diagnostics. Ushering in the next technological era, Fundamentals of Picoscience focuses on the instrumentation and experiments emerging at the picometer scale. One picometer is the length of a trillionth of a meter. Compared to a human cell of typically ten microns, this is roughly ten million times smaller. Klaus D. Sattler pursued his undergraduate and master's courses at the University of Karlsruhe in Germany. He received his PhD under the guidance of Professors G. Busch and H.C. Siegmann at the Swiss Federal Institute of Technology (ETH) in Zurich, where he was among the first to study spin-polarized photoelectron emission.Â He is the editor of the sister reference, Carbon Nanomaterials Sourcebook (CRC Press, 2016), Fundamentals of Picoscience (CRC Press, 2014), and the seven-volume Handbook of Nanophysics (CRC Press, 2011). Among his many other accomplishments, Dr. Sattler was awarded the prestigious Walter Schottky Prize from the German Physical Society in 1983. Fundamentals of Picoscience. By: Klaus D. Sattler. Publisher: routledge. Print ISBN: 9781466505094, 1466505095.Â The worldâ€™s #1 eTextbook reader for students. VitalSource is the leading provider of online textbooks and course materials. More than 15 million users have used our Bookshelf platform over the past year to improve their learning experience and outcomes. With anytime, anywhere access and built-in tools like highlighters, flashcards, and study groups, itâ€™s easy to see why so many students are going digital with Bookshelf.