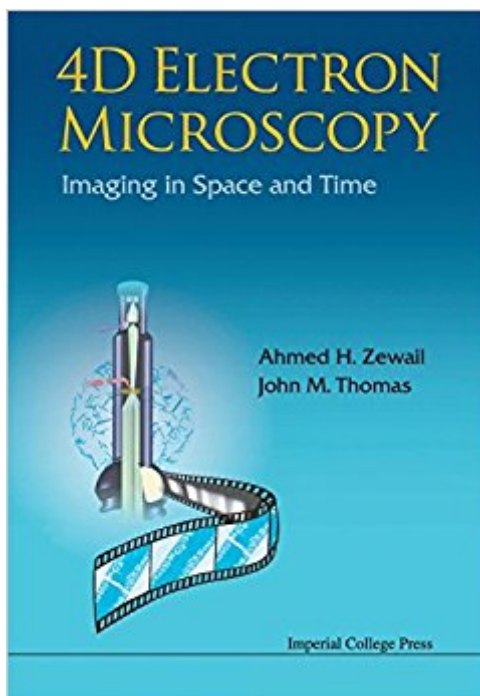


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4D Electron Microscopy: Imaging In Space And Time



Synopsis

The modern electron microscope, as a result of recent revolutionary developments and many evolutionary ones, now yields a wealth of quantitative knowledge pertaining to structure, dynamics, and function barely matched by any other single scientific instrument. It is also poised to contribute much new spatially-resolved and time-resolved insights of central importance in the exploration of most aspects of condensed matter, ranging from the physical to the biological sciences. Whereas in all conventional EM methods, imaging, diffraction, and chemical analyses have been conducted in a static - time-integrated - manner, now it has become possible to unite the time domain with the spatial one, thereby creating four-dimensional (4D) electron microscopy. This advance is based on the fundamental concept of timed, coherent single-electron packets, or electron pulses, which are liberated with femtosecond durations. Structural phase transitions, mechanical deformations, and the embryonic stages of melting and crystallization are examples of phenomena that can now be imaged in unprecedented structural detail with high spatial resolution, and ten orders of magnitude as fast as hitherto. No monograph in existence attempts to cover the revolutionary dimensions that EM in its various modes of operation nowadays makes possible. The authors of this book chart these developments, and also compare the merits of coherent electron waves with those of synchrotron radiation. They judge it prudent to recall some important basic procedural and theoretical aspects of imaging and diffraction so that the reader may better comprehend the significance of the new vistas and applications now afoot. This book is not a vade mecum - numerous other texts are available for the practitioner for that purpose. It is instead an in-depth expose of the paradigm concepts and the developed techniques that can now be executed to gain new knowledge in the entire domain of biological and physical science, and in the four dimensions of space and time.

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Customer Reviews

This book, by leaders in femtosecond spectroscopy and solid-state chemistry, gives an exciting overview of the new field of time-resolved transmission electron microscopy ... Despite the enormous challenges in this new field, this stimulating book from these authorities should be read by all graduate students about to choose a field of research. A book to make the experts think.

--Professor John Spence, Arizona State University, USA
This is a unique and ground-breaking book. For the first time it includes the important time dimension in electron microscopy, revealing time-resolved electron micrographs and diffraction patterns on an almost unbelievably fast time scale. The book is written with great clarity and is lavishly illustrated with some stunning micrographs.

--Professor Colin Humphreys, Cambridge University, UK
This is one of the most enlightening science textbooks I have ever read. The basic concepts behind 3D and 4D electron microscopy are presented in a concise and clear language, accompanied by figures of remarkable didactic content. This excellent textbook blends the qualities of an introductory with an in-depth account, and is bound to become a reference in the field.

--Professor Majed Chergui, EPFL, Lausanne, Switzerland
"This is a fascinating book, very timely published when electron microscopy (EM) is at a turning point with dramatically improved capacities ... The description of scattering of electrons and the function of the electron microscope is sufficiently complete to make this book well suited as a university textbook."

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"Combining the authors' expertise in femtochemistry, catalysis, and electron microscopy has resulted in a book that conveys the excitement and potential for this new paradigm in electron imaging ... there is no doubt that the development of the 4D microscope has introduced a new paradigm for characterization by TEM. Taken together with introductory texts covering TEM, it provides the understanding necessary for the reader to appreciate the principles of this brand new field."

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"The renowned authors of this new appearance on time-resolved 3D electron microscopy have created a fantastic book that will appeal to a broad range of scientists. Its topic and breadth will surely be of interest to those interested in physics, material science, and solid-state

chemistry â | The expertise of the authors and the clear, well-documented nature of the book combine to lend it great potential to set the standard in this field."--Angewandte Chemie "It is for the 'ultrafast' chapters that the book will be read for these contain new and very unfamiliar material. The book is handsomely produced with all the illustrations on a Cambridge blue background."

--Ultramicroscopy This is one of the most enlightening science textbooks I have ever read. The basic concepts behind 3D and 4D electron microscopy are presented in a concise and clear language, accompanied by figures of remarkable didactic content. This excellent textbook blends the qualities of an introductory with an in-depth account, and is bound to become a reference in the field.

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One of the best book i have ever read!

I discovered this book because it was referenced in a summary of the topic in Scientific American. I think the subject is important and fascinating. But after reading a few pages of the book, I decided regretfully that, as usual, before you can understand the latest scientific advances in any detail you have to master whole fields of science -- in this instance, optics and quantum physics. It's not the author's fault. He writes well, but there's no way to simplify the underlying prerequisites. (The annotated pictures in the Scientific American article did help to gain some notion of what's going on.)

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