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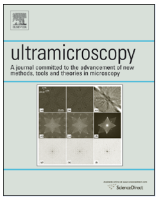

Scattered leaves

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ABSTRACT

Recent books and conference proceedings are surveyed, together with some lighter reading.

1. Books

> *[Sir Henry Savile] was so much of a book-worm, and so sedulous in his study, that his lady, who was not very deep in such matters, thought herself neglected. She once petulantly said to him, "Sir Henry, I would that I were a book, and then you would a little more respect me." A person standing by was so ungallant as to reply, "Madam, you ought to be an almanac, that he might change at the year's end". At this retort, the lady was not a little offended.*

There is no shortage of candidates for first place here and it required immense self-control to relegate *Chocolate and Health* to a later section. Instead, I have chosen a remarkable book on the *Physics of Schottky Electron Sources* by M. Bronsgeest, based on her Ph.D. dissertation [1]. This is the most detailed study I have ever seen of these sources (or indeed of any single type of source). In six substantial chapters, she covers Electron emission from a surface, Emission from a Schottky emitter, Emission from the end facet, The final beam for applications, Geometrical stability and Optimum operation. Each goes into the corresponding topic in detail, with abundant line diagrams and photographs and the assessments are always realistic and expressed in refreshingly forthright terms.

Next, two second editions, *Nanocharacterisation* [2] overseen by our editor and S.J. Haigh and R. Erni's *Aberration-corrected Imaging in Transmission Electron Microscopy* [3]. The new edition of *Nanocharacterisation* again has seven chapters by the same authors with a few newcomers apart from the last chapter: P.L. Gai's description of *in situ* ESEM has been replaced by 'Scanning electron and ion microscopy of nanostructures' by N. Erdman and D.C. Bell. As well as familiar background information, they describe new developments in column design and detectors and scanning ion microscopy. The 20 lines devoted to aberration correction in SEM suggest that it still has a long way to go.

Of the other chapters, two have been substantially revised, above all 'Scanning transmission electron microscopy' by A.R. Lupini and 14 co-authors. There are new applications and a section on emerging techniques, which covers low voltage STEM, Exploring the energy landscape, Image quantification and Novel detector configurations. The authors conclude that "One exciting prospect is that a new generation of monochromated instruments could have the same impact as the correction of spherical aberration". There is also new material and a section on time resolved electron tomography in the chapter by M. Weyland and P.A. Midgley.

As in the first edition, the other chapters cover Characterization of nanomaterials using transmission electron microscopy (D.J. Smith), STM of surfaces and nanostructures (M.R. Castell), EELS, EDX and WDX (M.R. Ward and 3 co-authors) and Electron holography of nanostructured materials (R.E. Dunin-Borkowski et al.).

The first edition (2010) of Erni's book on aberration-corrected imaging rapidly became essential reading for the aberration-corrected community. But since 2010, aberration correction has moved on and in particular, the battle to render parasitic aberrations, non-isoplanatic aberrations and higher-order aberrations harmless has achieved several victories. Erni has retained the basic structure of the first edition – three chapters on fundamentals, two chapters on electron optics and three chapters on aberration correction – modified as required, often extensively. In the first group, the use of segmented detectors in STEM is mentioned (though the names of Dekkers and de Lang, who introduced the idea, are not mentioned).

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A paragraph is devoted to so-called R-STEM in which the signal is collected in a plane conjugate to the specimen instead of in the far field. The second part is much the same as before and it is in the third part that most of the new material is to be found. There is a little more on C_c correction (here too, it would have been appropriate to give the names of Kel'man and Yavor who first pointed out the chromatic properties of mixed quadrupoles) and a good account of the correction of coma and other aberrations is provided; the question of stability and the unexpected statistical effect elucidated by S. Uhlemann are likewise mentioned. In the last chapter, Erni describes ways of measuring aberrations with a section on 'Ronchigram methods' (a reference to Lupini's chapter in Pennycook and Nellist's book on STEM would have been useful to supplement this brief account). Low-voltage HREM and radiation damage now have their own sections. An extremely valuable addition to the bookshelf, don't fail to replace your copy of the first edition.

F.L. Deepak, A. Mayoral and R. Arenal have assembled a collection of essays on *Advanced Transmission Electron Microscopy – Applications to Nanomaterials* [4]. The first chapter by M.J. Yacamán et al. offers a description of 'Aberration-corrected electron microscopy of nanoparticles'. This begins with a gallop through the history of the TEM and the STEM which is best avoided – it is full of statements such as "The first industrial microscope built by Ruska's team at the Siemens labs was a microscope with a very disappointing practical performance" (it was in no sense an industrial microscope and it was not built "at the Siemens labs"). "Chromatic aberration", we are told, "is usually directly related to the kind of electron gun being used and these aberrations are not difficult to correct using magnetic quadrupoles". The authors identify the birth of the electron microscope with de Broglie's introduction of a particle wavelength but Ruska and Knoll had not heard of this when they began work on electron lenses. Section 1.1.3 on TEM aberration correction gives no idea how correction is achieved; the same is true of section 1.1.5 on aberration correction in the STEM. The remainder of the chapter describes how clusters and nanoparticles are studied with aberration-corrected microscopes. In Chapter 2, F. Ruiz-Zepeda and four co-authors turn to 'Electron diffraction and crystal orientation phase mapping under scanning transmission electron microscopy'. Several pages are devoted to a close description of microscope settings for the 'D-STEM mode' described, including aberration-corrected operation. In the final section, 'Precession electron diffraction' is considered. In the next three chapters, several types of specimen are examined: multimetallic nanoparticles (N. Bhattarai and 3 co-authors), Zeolites and mesoporous crystals (A. Mayoral et al.) and carbon- and boron nitride-based nanomaterials (R. Arenal and O. Stephan). S. Moldovan et al. then discuss electron tomography and P.M.F.J Costa and P.J. Ferreira describe in situ TEM of carbon nanotubes. To conclude, J. Mast et al. tell us about Physical characterization of nanomaterials in dispersion by transmission electron microscopy in a regulatory framework, the Framework being that imposed by EC regulations on the use of nanomaterials in consumer products. This is full of good sense and the authors are well aware of the difficulty of satisfying such regulations.

M. Berz is well known in the charged-particle optics world and now, together with K. Makino and W. Wan, he has brought together his approach to the subject in *An Introduction to Beam Physics* [5]. The text is a perfect illustration of the spirit of the charged-particle optics conferences, the next of which will be organised by Berz, which were created to bring together specialists of accelerator optics, spectrometer optics and electron optics. Berz and his co-authors make no essential distinction between these domains so that section 1.2, 'Production of beams', describes electron sources, proton sources and ion sources. Chapter 2, Linear beam optics, is designed to encourage the reader to think in terms of matrix optics and I was sorry not to find any mention of Brouwer, author of *Matrix Methods in Optical Instrument Design* (1964). Two chapters take us through fields and potentials and the equations of motion in quadrupoles, deflectors and round lenses, which brings us to Computation and properties of maps. This is an essential element of the book in which differential algebras, Berz's speciality, are introduced. These are often found difficult, not to say rebarbative, but the presentation here is so clear and the explanations so easy to follow that all those difficulties dissolve. Chapter 6 deals with linear phase space motion after which Chapter 7 describes Imaging devices, which include electron microscopes and their correction. The section on aberration correction in PEEM and LEEM is particularly valuable as is all the discussion of the various correctors. The remaining three chapters are mainly of interest to the accelerator community: Periodic transport, Lattice modules, Synchrotron motion and Resonances in repetitive systems. Altogether, a clearly written and unusual text to stand next to Rose's *Charged Particle Optics* (and Kasper's and my *Principles*).

I was misled by the title of *Strain and Dislocation Gradients from Diffraction* edited by R. Barabash and G. Ice [6]; this deals almost entirely with x-ray techniques; only the chapter by D. Fullwood and 6 co-authors mentions electrons: 'Microstructure detail extraction via EBSD, an overview' ("survey" appears to have joined the threatened species). The other 12 chapters cover many aspects of x-ray diffraction, such as 'Reconstructing 2D and 3D x-ray orientation maps from white-beam Laue' (J.Z. Tischler). The volume is nicely produced with some colour and titles are included in the references.

The collections of essays on *Noncontact Atomic Force Microscopy*, edited by some or all of S. Morita, F.J. Giessibl, E. Mayer and R. Wiesendanger, have now reached volume 3 [7]. The 22 chapters range from S. Morita's Introduction to an account of High-speed atomic force microscopy by T. Uchihashi et al. I cannot list all the other 20 chapters but they describe in great detail such topics as 3D force field microscopy, The phantom force, Non-contact friction, Magnetic exchange force spectroscopy, Single molecule force spectroscopy and Atomic-scale contrast formation. As I have recently been reading about the 'phantom forces' created by mediums in the 19th century (and doubtless since), I naturally turned to the corresponding chapter by A.J. Weymouth and F.J. Giessibl. The medium Daniel Hume managed to send an accordion flying across the room during a séance and even persuaded it to play itself! There is nothing quite so colourful in this chapter and the explanation of the phantom source is rather more subtle than that of Hume's exploits. This volume will surely be indispensable to all AF microscopists – it is beautifully printed with colour in place throughout.

In the series Springer Theses is a volume by M. Taylor on *Quantum Microscopy of Biological Systems* [8]. What, you may be asking, is quantum microscopy? "A powerful and relevant technique for future applications in science and medicine" says the blurb. No doubt, but we are not much further forward. However, in 'Thesis aims', we learn that the "goal of this thesis is to enhance biological measurements by using non-classical states of light. More specifically, we aim to apply squeezed light to enhance the sensitivity of optical tweezers based particle tracking, and to use this device to perform biophysical experiments". Chapter 1 is not easy reading but subsequent chapters are much less opaque. Part I, 'The quantum limit to particle tracking sensitivity', attacks such questions as 'How much information can a photon carry?' and examines the quantum noise limit of phase estimation and quadrant detection. Part II covers 'Classically optimizing sensitivity' and the last part describes 'Quantum enhanced optical tweezers'. If the author and his supervisor, W. Bowen, are right in believing that "sub-diffraction-limited images with Angstrom-scale resolution may [become] possible [and that] This would provide access to