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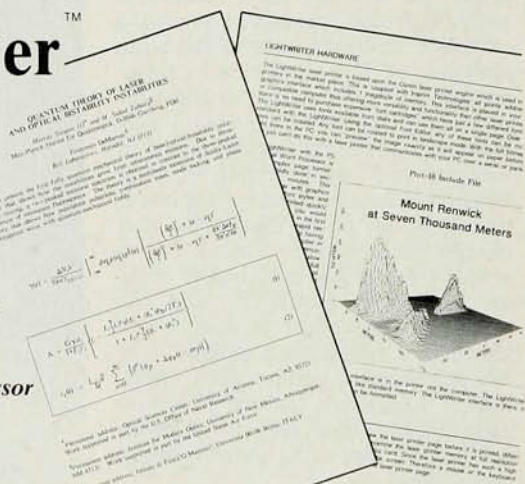
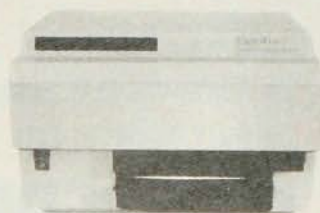
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thorough coverage of the fractional case. The theoretical situation receives a very complete coverage in eight chapters.

Rather than producing a collection of technical articles intended for specialists, the authors have all made special efforts to introduce their subject in a pedagogical but informal way. Prange has supplied a very readable introduction to the subject, while Girvin has supplied a summary chapter, which is refreshing in that it places its emphasis on what is not known and reports on original research that points to future directions. The choice of topics is generally excellent, even though one wishes that less orthodox ideas such as cooperative ring exchange could have been represented.

On the whole the book achieves the stated goal of reviewing the subject in depth and yet at a level accessible to graduate students in physics. It serves as a valuable guidepost in this still rapidly developing field and should be a standard reference for years to come.

PATRICK LEE

Massachusetts Institute of Technology

Electron Energy-Loss Spectroscopy in the Electron Microscope

Ray F. Egerton

Plenum, New York, 1986.

410 pp. \$59.50 hc

ISBN 0-306-42158-5

The last decade has witnessed the remarkable development of the analytical electron microscope, a hybrid instrument that combines the imaging and diffraction capabilities of the transmission electron microscope, scanning transmission electron microscope and scanning electron microscope with analytical spectroscopies. The AEM provides elemental characterization of thin, solid matter with a lateral spatial resolution of tens of nanometers while displaying morphological structure to a fraction of a nanometer. While most current applications of the AEM for elemental analysis make use of energy-dispersive x-ray spectrometry because of its inherent simplicity, the complementary but more complex technique of electron energy-loss spectroscopy offers the greatest promise for future improvements, particularly for improving the spatial resolution of analysis to a scale of 1 nanometer. What has been hindering a greater acceptance of EELS among the general electron microscopy community has

been the lack of a single source reference on the topic. In this, the first comprehensive book on EELS, Ray Egerton has produced a detailed description covering all aspects of theory and practice necessary to successfully implement the technique on the modern AEM.

The energy loss spectrum shows the consequences of inelastic scattering of the initially monoenergetic beam electrons. The myriad inelastic interactions can convey an extraordinary range of information about elemental composition, chemical bonding, interatomic distances, bond angles and the degree of atomic disorder. Upon first examination, it would appear that EELS offers so much more information than the x-ray signal that it would inevitably be the analytical signal of choice, but this is not the case in practice. As Egerton notes, "EELS is a fairly demanding technique, requiring for its full exploitation a knowledge of atomic and solid-state physics, electron-optics, and electronics." Egerton, who is recognized as one of the world's leading researchers in the theory and application of EELS in the electron microscope, succeeds admirably in his goal of gathering in one book a comprehensive collection of information on EELS, including detailed descriptions of instrumentation, electron optics and electron scattering theory. Such an approach is needed if EELS is to move beyond the small club of current practitioners to wider acceptance in the materials science and biological communities.

While very few members of this second tier of EELS users are ever likely to fabricate an energy-loss spectrometer from scratch, preferring rather to employ commercially available spectrometers, Egerton's detailed account of the physical basis of the design of the instrumentation will prove valuable to those who wish to know the relative strengths and weaknesses of the various types of spectrometers. With an emphasis ever on the practical, the book provides extensive details to aid the microscopist in recognizing and correcting various instrument-induced artifacts in the spectrum.

The particular strength of the book lies in its thorough and readily understandable description of electron scattering. Building upon this physical description, Egerton carefully constructs the detailed basis for quantitative analysis, including the mathematical procedures used to separate characteristic edge information from the high and rapidly varying spectral background. Appendices provide FOR-

TRAN codes for several of the critical mathematical operations, including Fourier-log spectral deconvolution, partial cross sections based on the hydrogenic approximation for K-shell and L-shell ionization, and Kramers-Kronig transformations.

The final section of the text reviews a wide variety of practical applications, including measurement of specimen thickness, phase identification, measurement of alloy composition, detection of hydrogen and helium, EELS imaging, core-loss elemental microanalysis, measurement of radiation damage, and structural information from fine structure in the EELS spectrum.

This book will prove invaluable to a wide range of users of analytical electron microscopy, particularly in the materials science, technology and biological science communities, where EELS is usually considered an answer in search of a question. With its emphasis on practical matters in obtaining high-quality EELS spectra in the laboratory and its thorough descriptions of the underlying theory and quantitative chemical analysis, the book provides a comprehensive view of this promising technique.

DALE E. NEWBURY

National Bureau of Standards
Gaithersburg, Maryland

Thermodynamics of Point Defects and Their Relation with Bulk Properties

P. A. Varotsos and
K. D. Alexopoulos

North Holland, New York,
1986. 472 pp. \$115.50 hc
ISBN 0-444-86944-1

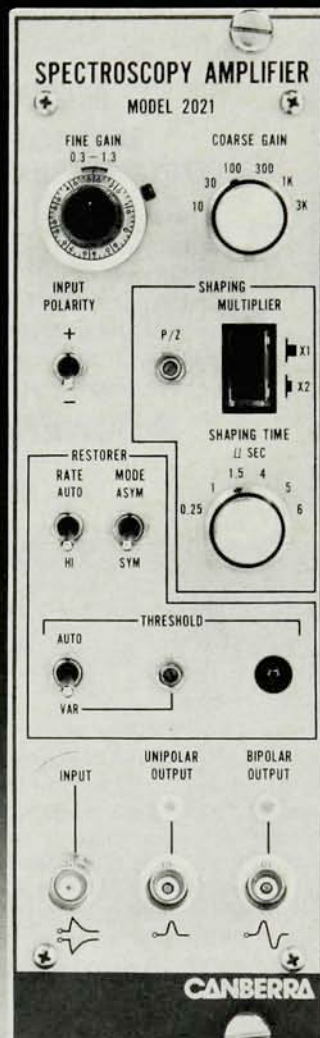
The search for correlations among physical properties of solid materials has a long tradition. Both scientists and engineers have tried various ways of summarizing existing knowledge about such properties. Sometimes the goal is to relate a variety of properties through an underlying physical model. Often the goal is to provide an empirical framework within which one can judge the justness of an existing or new measurement of a property or from which one can obtain an unknown value. Much modern technology depends on materials, increasingly used under extreme conditions, and the appearance of well-founded methods is welcome.

P. A. Varotsos and K. D. Alexopoulos detail in this book their search for a unifying framework to correlate the many measurements that have been

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