detailed description of the determination of a number of rather complex crystal structures. Chapters X, XI and XIII of the third part are written by C. Weeks. Together with the exercises introduced by the author in the theoretical part of the monograph, there are practical examples in the final chapters which turn the monograph into a very useful textbook for mastering this new variant of direct methods. The idea of application of cosine seminvariants to crystal-structure determination, which appears to be worked out in a rigorous and systematic manner, brings us nearer to the stage where the calculation of the phases of structure amplitudes from X-ray diffraction experimental data will become a routine procedure. Following the monographs by H. Hauptman and J. Karle, *Solution of the Phase Problem*, New York, 1953; by A. I. Kitaigorodskii, *Theory of Structure Analysis*, Moscow, 1957; and by M. M. Woolfson, *Direct Methods in Crystallography*, Oxford, 1961, the book under review is undoubtedly an important contribution to the development of the theory and application of direct methods of crystal-structure determination.

In conclusion, the reviewer would like to say that it is perhaps regrettable that no references are found to the above mentioned monographs by Kitaigorodskii and Woolfson as well as to the works of I. M. Rumanova [*Dokl. Akad. Nauk SSSR*, (1954), **98**, No. 3, 399], S. V. Borisov, V. P. Golovachev & N. V. Belov [*Kristallografiya*, (1958), **3**, No. 3, 269] and to some other works which are important for understanding the development of direct methods. Because of this, the bibliography at the end of the book appears to be rather impoverished.

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Phase transitions and critical phenomena, Vol. 1. Edited by C. Domb and M. S. Green. Pp. 506, 105 Figs., 4 Tables. London and New York: Academic Press, 1972. Price £ 10·00.

This book is the first of a series of volumes whose aim is 'to present a coherent account of all that is definitely known about phase transitions and critical phenomena and to provide a standard reference for some time to come, particularly for graduate students'. At present two volumes have been published and two more are in preparation. This volume is subtitled 'Exact Results' and comprises a collection of eight specially invited papers.

A brief introductory chapter by C. N. Yang on the historical development of the subject is followed by a chapter by R. B. Griffiths entitled 'Rigorous Results and Theorems'. The idea of the thermodynamic limit is introduced and its existence in the case of the Ising models of the ferromagnet and the lattice gas is proved. The remainder of the chapter surveys a number of topics such as the conditions for the existence or otherwise of phase transitions in one- and two-dimensional lattices and the inequalities relating various critical-point exponents.

Following chapters on Dilute Quantum Systems and C^* Algebra by J. Ginibre and G. G. Emch respectively, the topics of one- and two-dimensional systems are taken up again. The detailed discussion of one-dimensional lattices and their partition functions by C. J. Thompson may seem somewhat out of place when it is realized that phase changes occur in one-dimensional systems only in the exceptional cases of particular long-range interactions. However the susceptibility of one-dimensional models to exact analysis makes them a useful illustration of the statistical-mechanics method. The chapter on two-dimensional Ising models by H.N.V. Temperley includes a description of what is still the most famous exact result in the theory of phase transitions: Onsager's solution to the two-dimensional Ising model. This solution is described in some detail and its mathematical implications are discussed. The final two chapters of the book discuss the transformation of Ising models (I. Syozi) and the analysis of two dimensional 'ice-like' ferroelectric models (E. H. Lieb and F. Y. Wu). This last chapter which occupies nearly one third of the book, describes a number of two-dimensional problems with directed bonds, whose partition functions can be evaluated exactly and whose critical behaviour can thereby be predicted.

This book is not one in which crystallographers should expect to find theories which will explain their experimental results on, for example, structural phase transitions in crystals. It is significant that none of the well known names of the experimental or theoretical workers in the Edinburgh lattice-dynamics group appear in the extensive list of references, even although one third of the book is devoted to a study of (albeit two-dimensional) ferroelectric lattices. This serves to emphasise the dichotomy between those who are looking for a theory which will explain their experimental results and those who are looking for models capable of rigorous theoretical investigation; it is to be hoped that future volumes in the series will attempt to bridge this gap. In the meantime the mathematically well equipped graduate student or research worker who wishes to study a rigorous treatment of the theory of phase changes could well find this book useful.

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Practical methods in electron microscopy. Vol. 1. Edited by Audrey M. Glauert. Pp. viii + 444, 211 Figs., 8 Tables. Amsterdam: North Holland, 1972. Price *f* 110.00 (*ca.* US $34.50).

This book, as its title implies, is essentially directed at research workers who want to know exactly how the various operations in electron microscopy are carried out. It is written by people who have intimate knowledge of the subject, and, in addition to full descriptions of experimental detail, lists of suppliers of necessary items – ranging from electron microscopes themselves to storage boxes for specimens – are given at the end of each section.

The format of the book is rather odd. It is three books in one, and the first part has its own appendices and index. The second part has two sections, each with its own chapter numbering, but with appendices at the end of the first section and index at the end. Thus the book has three Chapter 1's, for example. It is all very confusing and makes cross-referencing very difficult.

The subjects treated are specimen preparation, interpretation of electron-diffraction patterns, and application of optical-diffraction methods. These are all treated in great detail, so that the reader should have no difficulty in following the instructions given. If the book had confined itself to this aspect, it would have been very good, but it is spoilt by quite inadequate – sometimes incorrect – excursions into theory.

For example, the following are some of the statements that appear.

Lattice planes 'are not simply abstract planes joining arbitrary points along the major axes of the unit cell but are the planes which actually contain the atoms that make up the crystalline lattice'.

'It is axiomatic that whenever an image is formed in the image plane of the objective lens, a diffraction pattern is formed in the back focal plane'. (This is true only if the illumination is coherent.)

'The "image" is known as the diffraction pattern'.

'Fig. 4.1. The electron microscope considered as a simple electron diffraction camera'. (Legend to a figure merely showing Bragg reflexion.)

In addition to faults of this sort, some of the figures are rather poorly drawn, and would not help the reader to understand the text.

The final section is more competent. Here the book suffers from lack of a clear statement of what optical methods are used for and of examples of their use. Fig. 8.13 (p. 428) is an exception; it gives a striking example of the use of superposed translated pictures, showing clear detail from a rather confused original. But even this illustration is marred by the fact that the original is not at the same magnification as the final picture.

Altogether the book is disappointing. It would have been much better if it had kept to its main purpose and had not attempted to compete with the many quite adequate theoretical books that already exist.

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Microwave ultrasonics in solid state physics. By J.W. TUCKER and V.W. RAMPTON. Pp. x+418, 81 Figs., 31 Tables. Amsterdam: North Holland, 1972. Price *f* 130.00 (*ca.* US $40.75).

Ultrasonics is well established as a research tool in solid-state physics, and a number of excellent books and reviews have already been published. Until recently, the highest frequency that could be obtained was only about 1 GHz, representing the extreme limit of a resonant piezoelectric transducer. In the last few years, however, methods have been developed for extending the frequency range of ultrasonic experiments well into microwave region, as high as 114 GHz on one occasion, and commonly around 10 GHz. This increase in frequency is significant since it has enabled the quantum aspects of lattice waves to be studied in greater detail, particularly the interaction of phonons with other elementary excitations in solids. The present book sets out to describe the new areas of solid-state physics that have become accessible as a result of these advances in ultrasonic technique.

The book begins with a short theoretical introduction to lattice dynamics and elastic-wave propagation in solids. This is followed by a detailed account of the new experimental techniques on which the sub-field of microwave ultrasonics has been founded. The theory and practice of non-resonant piezoelectric, magnetostrictive, and thin-film transducers are covered, and much useful working detail is given on technicalities such as the design of microwave cavities and the preparation of specimens and bonds. One chapter is devoted to the attenuation of ultrasound in dielectric crystals, that is, by scattering from thermally excited phonons. Microwave ultrasonic investigations have played a large part in elucidating the details of the phonon–phonon interaction, and the role of key features such as elastic anisotropy and thermal-phonon lifetime is well brought out in this treatment. Another area which has been greatly stimulated by the recent advances in ultrasonics is that of acoustic paramagnetic resonance. Both authors have been closely associated with the field and this section is particularly comprehensive. In addition to experimental details of the technique, the theory of the spin–lattice interaction is described at length although relatively few results are quoted. The propagation of ultrasonic waves in semiconductors is also discussed, with details of ultrasonic amplification and of non-linear and acoustoelectric effects.

The two chapters that must, regrettably, be criticised, are those dealing with ferromagnetic materials and with ultrasonic propagation in metals. Roughly a half of the section on ferromagnetism is taken up with a review of spin-wave theory that is inadequate as a general treatment but is overdeveloped for the present purposes. Furthermore, most magnetoelastic experiments have been carried out below 1 GHz and it is not clear that microwave ultrasonic studies have contributed greatly to the subject. But in the context of metals the authors invoke this very argument – that the field is essentially one for low-frequency ultrasonics – to limit their treatment to a brief summary of the various mechanisms of ultrasonic attenuation by electrons. Although much ultrasonic work has indeed been carried out below 1 GHz, high-frequency techniques are increasingly being used to study, for example, quantum and geometric oscillations in normal metals and scattering of phonons in superconductors. A more comprehensive account would certainly have been worthwhile. The final chapter reviews the interaction of light with microwave ultrasound (Brillouin scattering), and there are several useful appendices, mainly of crystal matrices and coefficients.

The mathematics of the book is pitched at about first or second year graduate level, and in general is presented very clearly. The references and the subject matter are complete to about the end of 1970. It is unfortunate that the volume has been produced so expensively, since the price of £17 will probably be beyond those who might benefit the most from the book.

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