pretation 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.

H. LIPSON

Physics Department
Manchester University
Institute of Science and Technology
Sackville Street
Manchester M60 1QD
England

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.

J. K. WIGMORE

Department of Physics
University of Lancaster
Lancaster
England