measure the relevant elastic properties of building materials.

Two decades later, Manfred Heckl collaborated with Cremer to produce a revised and expanded German-language version, published in 1967 under the title *Körperschall-Physikalische Grundlagen und Technische Anwendungen*. Now, translated back into English by Eric Ungar, with some further revisions and additions, it becomes available at last to the whole community of English-speaking acousticians.

The subject of structure-borne sound is a difficult one, involving the complexities of airborne waves in spaces as well as those of propagation in various structural elements and assemblies. The authors steer a careful course through these intricacies, finding solutions that are at the same time physically realistic and amenable to mathematical analysis.

Although it is primarily a theoretical book, most of the results are supported by experimental evidence. Appropriately it begins with a review of transducer characteristics and the measurement techniques needed for such experimental studies. The next few chapters examine the vibration behavior of simple structural elements, the concept of impedance as it applies to coupling between airborne sound waves and structures, damping mechanisms and methods of expressing them in mathematical analysis, and similar basic material. Finally this material is used to describe the behavior of structural systems of special interest in building acoustics. The authors make no attempt at an exhaustive bibliography, but the more essential references, especially to experimental work, are included.

For any acoustician with a claim to competence in this field the book should become an essential reference. For many engineering problems it will constitute a direct basis for design; for the theorist, it will provide the starting point for the study of other more complex ystems. For the neophyte it will provide an integrated and lucid exposition of the ramifications of structure-borne sound.

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Treatise on Solid State Chemistry Vol. 1: The Chemical Structure of Solids

N. B. Hannay, ed.
540 pp. Plenum, New York, 1974. $35.00

This is the first volume of a six-volume treatise whose stated purpose is to outline the basic chemistry, physical chemistry and chemical physics of solids, and to help define the field of solid-state chemistry.

In this volume, N. B. Hannay has assembled eight chapters contributed by nine well-known specialists on various aspects of the chemical bond, structure, composition and defects in solids. As is to be expected in an endeavor of this kind, the sought-after unity is elusive, and the various contributions have differing degrees of excellence. Nevertheless, to those working in the solid-state sciences, this book will be of value in introducing them to subjects outside their area of specialization.

The content of this book can be divided into four parts: chapters 1, 2 and 3 deal with the chemical bond, energy bands and phases, chapter 4 is a presentation of the relation between properties and structure, chapters 5 and 6 constitute an introduction to crystal defects and chapters 7 and 8 comprise an outline on the characterization of solids.

In chapter 1, J. C. Phillips summarizes an approach to the chemical bond in solids that is in the Pauling tradition. That such an approach is useful, and even necessary, in spite of the great sophistication of modern solid-state theory illustrates the complexity of the nature of crystals.

Dennis Weaire's chapter is a well done, straightforward exposition on energy bands. One wishes, however, that he would have paid some attention to the theory of cohesion and its relation to the chemical bond. It would have been more in accord with the objectives of the book.

The most successful part of this book consists of chapters 5 and 6 by Morris E. Fine and George G. Libowitz respectively on defects in crystals. Fine's chapter is an excellent descriptive account of structural defects, while that of Libowitz is a unified presentation of point-defect equilibrium in elemental and compound crystals, including the effects of non-stoichiometry and external pressure.

By contrast, other parts of the book suffer from a lack of unity inherent in the subject matter itself. Chapters 7 and 8, for example, sometimes give the impression of cataloguing techniques without sufficient analysis of results. The problem of the characterization of solids is of critical importance, but depends on such a great variety of methods that it is difficult to summarize.

One of the most interesting chapters is the one by J. H. Wernick in which he describes magnetic, superconducting, dielectric and mechanical properties in terms of structure and composition. It is a good exposition of how the atomistic controls the macroscopic.

In summary, this is a useful book for graduate students as well as more ad-

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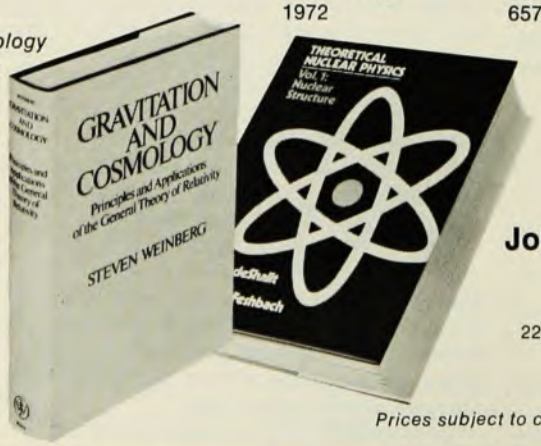

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vanced workers who want some information outside their own area of specialization. Most of this information is available in other places, but not always in a collected, easily accessible form. Except for the section on defects, the book cannot stand on its own as a unified introduction to the subjects treated. But considering the wide range of subjects and their complexity, the contributors have done a creditable job of giving the intended audience a starting point for further study.

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The Interpretation of Quantum Mechanics

M. Audi
200 pp. U. of Chicago Press, Chicago, 1974. $11.50

Quantum Mechanics in a New Key

A. Landè
131 pp. Exposition Press, Jericho, New York, 1973. $6.50

"Matter particles and electromagnetic fields have physical reality, but matter waves and photons have not, although they may be helpful for calculation purposes in special cases," (Landé, page 26). This is the common point of view espoused by these authors. Alfred Landé is a senior physicist who has written many books and articles on quantum theory. Michael Audi is a philosopher, and this, his first book, is based on his doctoral dissertation.

The arguments in favor of the above-quoted statement range from convincing to merely suggestive. The best of them, in favor of the reality of material particles and against that of "matter waves," was pointed out by Landé long ago. It is that the wave-like appearance of an electron diffraction pattern is in fact nothing but a statistical pattern of particles, and that diffraction-like scattering of particles takes place because the momentum transferred to or from an object with spatial period l (such as a crystal) is quantized in multiples of $\Delta p = h/l$. This rule, proposed *ad hoc* by W. Duane in 1923, becomes a theorem in modern quantum theory. On the other hand, the arguments against the reality of photons are only suggestive, and neither author has taken account of the interesting recent discussions of the degree to which the photon hypothesis is or is not necessary in electrodynamics.[1]

Audi sees a contradiction between two assertions of the Copenhagen interpretation: firstly, that classical concepts, in particular the *particle* concept, cannot be accurately applied to physical systems, and yet, secondly, quantum theory requires these classical concepts for its formulation. In classical physics a *particle* is a point-like object having a continuous trajectory and hence simultaneously possessing position and momentum, but an old interpretation of the uncertainty principle denies this to be possible. Audi resolves this contradiction by emphasizing that the uncertainty relations refer to the dispersion among the paths of an ensemble of particles, not to a single particle. The difference of quantum theory from classical theory is not that electrons do not possess definite particle properties like position and momentum, but rather that they lack laws that determine the future values of those properties.

Audi's thesis, that the possession of definite properties need not require the existence of laws determining their future values, is important. However it is less original than he believes, for Einstein's claim that quantum mechanics is incomplete was based on the inability of a state vector to describe such properties as simultaneous position and momentum, and not (as Audi erroneously states on page 137) merely on its lack of determinism.

In addition to expounding an interpretation, Landé attempts to *derive* the essential features of quantum mechanics from the principles of *symmetry, correspondence,* and *covariance.* He has devoted three earlier books to this problem, and this, his "final version," is disappointing for its failure to answer the criticisms of the earlier volumes. Much of Abner Shimony's penetrating criticism[2] of Landé's 1965 book is applicable to this one as well.

A good illustration is provided by his derivation of the relation between a coordinate q and its conjugate momentum p:

$$\psi_{pq} = C \exp(2\pi i\, pq/h) \qquad (A)$$
$$(= \langle q|p\rangle \text{ in the usual notation})$$

From the postulate of covariance, or independence of the dynamics from arbitrary zero points of coordinates or momentum, he obtains equations equivalent to: (i) $\psi_{pq_0}\psi^*_{p'q_0}$ = function of q_0 and $p-p'$ only; (ii) $\psi^*_{p_0q}\psi_{p_0q'}$ = a function of p_0 and $q-q'$ only. Although the argument leading to them is not unobjectionable, these equations form a well-defined mathematical problem, to which Landé asserts that (A) is the unique solution. But that claim is not true, for $\psi_{pq} = \exp(iaq - ibp)$ also satisfies (i) and (ii). The existence of this unwanted solution was pointed out by Landé in an earlier book,[3] where he eliminated it with an *ad hoc* argument. Now he merely ignores it although it is not excluded by his postulates.

More serious than this technical flaw