Lattice Vibrations

Dynamical Properties of Solids. G. K. HORTON and A. A. MARADUDIN, Eds. North-Holland, Amsterdam, and Elsevier, New York, 1974 and 1975. Vol. 1, Crystalline Solids: Fundamentals. x, 662 pp., illus. $93.75. Vol. 2, Crystalline Solids: Applications. x, 536 pp., illus. $83.50.

One of the most important consequences of the atomic ordering predominant in the solid state is the vibrational motion that the atomic constituents experience in the lattice. These vibrations manifest themselves in a variety of ways: transmission of sound in solids, appearance of phase transitions, ordinary infrared and Raman spectra, piezoelectricity, and melting of the solid, to mention just a few. The standard reference text in the field is Born and Huang's classic, *Dynamical Theory of Crystal Lattices*, published in 1954. Since that year, important developments have occurred, and although review articles and specialized textbooks have been produced, a comprehensive summary of the state of the art has been lacking. This badly felt need will be handsomely filled when all three volumes of this work have been published. Horton and Maradudin have managed to gather a truly international group of contributors, each of whom is a recognized authority in his own area, and the two volumes under review constitute one of the most comprehensive, authoritative, and clear expositions that I have seen in the literature for some time.

Volume 1, dated June 1974, discusses from various points of view the most basic aspects of lattice dynamics. It includes expositions of the elements of the basic theory (Maradudin); symmetry aspects (Birman); phenomenological models (Hardy); lattice vibrations in metals (Brovman and Kagan); covalent (Sham) and ionic (Bilz, Gliss, and Hanke) crystals; anharmonicity in its weak (Barron and Klein) and strong (Horner) forms; and a theoretical approach to a self-consistent picture (Götze and Michel). It ends with a welcome review of neutron diffraction spectroscopy as applied to lattice dynamics (Dolling). This volume in itself is a compulsory addition to the library of any solid state physicist.

Volume 2, dated September 1975, covers areas not included in the first volume. It discusses quantum crystals (in a chapter by Koehler that is devoted exclusively to solid helium), ferroelectrics (Gillis), and molecular solids (Schnepp and Jacobi). It goes on to describe thermoconductivity and second sound (Beck), and the last three chapters are devoted to the study of the influence of the lack of periodicity caused by impurities in the solid (Taylor), alloying and mixed crystals (Elliott and Leath), and surfaces (Wallis).

I found the chapters uniformly good, with enlightened discussions and clear presentations. There is the repetition that is to be expected in a multiauthor work, but this helps the reader to read each section as if it were self-contained, and is not burdensome. The book is properly set, pleasantly displayed, and well illustrated.

Volume 3, "Crystalline and Noncrystalline Solids," which was promised for 1974, is now apparently scheduled for publication in 1976. Chapters on infrared and Raman spectroscopy, amorphous materials, and possibly transition metals may be included in this last volume.

To my enthusiasm for the book I have to add my dismay at its price.

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Cancer Epidemiology

Persons at High Risk of Cancer. An Approach to Cancer Etiology and Control. Proceedings of a conference, Key Biscayne, Fla., Dec. 1974. JOSEPH F. FRAUMENI, JR., Ed. Academic Press, New York, 1975. xx, 544 pp. $19.

This book is a report of a conference sponsored by the National Cancer Institute and the American Cancer Society. It deals with cancer etiology and control as viewed by epidemiologists, though it is natural that there should be some overlap with the concerns of basic scientists and clinicians interested in such problems as precancerous lesions or chemical carcinogenesis.

The 32 chapters of the book have been organized into six sections, each of which ends with a brief overview. The opening section deals with attributes of the host that are important in the development of cancer. It is followed by a section on aspects of the environment—drugs, diet, air pollution, viruses, and sexual factors—that have been shown to play a part in carcinogenesis. Whereas the sections on host and environment center on specific factors, the succeeding section is concerned with "leads" to etiological factors, such as variation in cancer rates between geographical areas within the United States, or between countries, or between migrant and nonmigrant portions of a population.

The fourth section deals with the prevention or early detection of cancer that is made possible when risk factors become known. The fifth section consists of papers rather awkwardly grouped under the heading Further Delineation of High-Risk Groups. It has a chapter on cancer control, one on environmental cancer, one illustrating the integration of epidemiological and laboratory investigation, and an overview of the whole conference. The book concludes with two brief chapters on prospects for cancer control and for the study of etiology.

The flavor of the book can be illustrated by reference to three chapters—those on familial susceptibility to cancer, international variation in high-risk populations, and geographic patterns of cancer mortality in the United States.

Traditionally, epidemiologists looking for evidence of familial aggregation of a disease have followed a method used by Wade Hampton Frost. This is often known as the proband method, though human geneticists reserve that term for studies in which an explicit model is tested, and in the chapter under discussion the label "retrospective" rather than "proband" is used. Epidemiologists begin by identifying a group of patients (probands) with a given disease, assemble a suitable control group, and then compare the incidence of the disease among specified relatives of the two index groups. A study of twins may also be used to find evidence of hereditary disease; such a study can in fact be regarded as a form of proband study in which the affected group consists of monozygous twins with a given disease, the control group consists of dizygous twins with the same disease, and the measurement of concordance rates is the measurement of the incidence of the disease among the co-twins of the two groups. A third method of detecting familial aggregation is that of testing an explicit genetic hypothesis by means of pedigree studies—that is, studies of single families in which cancer has occurred. Tumors may occur at any given site in either inherited or noninherited form, and pedigree analysis has the important advantage of permitting the investigator to focus on the inherited form. Characteristics of this form are onset at an early age and a tendency to develop at multiple sites.

International variation in incidence of cancer of specific sites is striking. The best available data on incidence rates show the following ratio of the highest to the lowest age-adjusted rates: 176 for cancer of the esophagus, 95 for cancer of the liver, and 72 for cancer of the bronchus and lung. These comparisons