solids, it is worth examining this book to appreciate how much freedom the resonator has with the effective-spin Hamiltonian. After all, tensorial coupling is not uncommon, and who can resist the challenge to improve on Nature?

• • •

Allen Garroway is a member of the Chemistry Division of the US Naval Research Laboratory. He is currently applying high-resolution solid-state NMR spectroscopy to the study of polymeric materials.

The Linear Electric Field Effect in Paramagnetic Resonance

W. B. Mims
339 pp. Oxford U. P., New York, 1976. $21.50

William Mims has written a much-needed book covering the experimental and theoretical aspects of the effect of electric fields on electron-spin-resonance spectra. Most ESR studies are essentially Zeeman-effect measurements, in which the influence of the applied magnetic field is dominant in producing the energy-level splittings that are measured. In recent years simultaneously applied electric fields have been used to produce more detailed characterizations of the paramagnetic centers that are studied by ESR. The present book surveys the status of these studies.

The author reported some of the early results on electric fields applied to ESR, and he has been quite active in the field. His background makes him well qualified for writing the book. The main audience for this volume will be physicists and chemists working in the area of magnetic resonance; more recently, biological scientists too have been active in this field.

After a brief introductory chapter Mims presents a description of various experimental apparatus and techniques used to carry out electric-field ESR experiments. A knowledge of the operating principles of standard ESR spectrometers and of the associated experimental techniques is presupposed. The information in this chapter and in the references quoted therein can be used to adapt standard spectrometers for electric-field studies.

The basic theory presented in the next three chapters emphasizes the treatment of spherical and Cartesian tensor terms in Hamiltonians. A novel notation, in which Cartesian electric-field terms are coupled to crystal-field spherical tensor terms, is also introduced. The author develops the theory for crystal fields at noncentrosymmetric sites by comparing the symmetry effects of the 21 noncentrosymmetric point groups to those associated with their 11 centrosymmetric counterparts. A number of useful tables give transformation coefficients and relationships between point symmetries and resonance properties of ions. These theoretical chapters presuppose a background in angular momentum and crystal-field theory. The illustrative calculation of the $4f^1$ case of cerium presented in Chapter 6 is very helpful, but its usefulness would have been improved by a section on extensions to multi-electron cases.

Various special cases and applications are presented in the next three chapters. To some extent these topics reflect the personal preferences of the author, such as the strong emphasis on ENDOR and the somewhat cursory treatment of ferroelectrics. The final chapter gives a good summary of experimental results classified by site symmetry. The data are summarized in tables. The appendices on mathematical background material and line-broadening effects contain much useful information.

On the whole this book is recommended reading for magnetic-resonance research workers with an interest in electric-field effects.

CHARLES P. POOLE, JR.
University of South Carolina
Columbia

Atomic Dynamics in Liquids

N. H. March, M. P. Tosi
330 pp. Halsted, New York, 1977. $39.50

During the 1960's and early 1970's substantial advances were made in the theory of simple liquids (those composed of atoms), especially for the equilibrium properties of the bulk phase. These advances included the development of integral-equation methods and of highly successful perturbation theories; by comparing the theoretical calculations with computer-simulation studies and with experiment (particularly neutron x-ray measurements), it has proved possible to proceed with some confidence in building a rather complete understanding of atomic liquids at equilibrium. Research on liquids is shifting now towards the more difficult problems of molecular liquids, surface properties, charged particles, transport processes and others.

These successes have led to something of a spate of books on liquids in the last few years; with rare exceptions these deal almost exclusively with atomic liquids (usually taken to mean liquid argon). The book by Norman March and M. P. Tosi is no exception in this respect, although they consider liquid metals and fused salts as well as the inert gases. However, the March–Tosi book differs in both style and coverage from other recent monographs. Experimental studies of liquids by neutron scattering are stressed, and the many comparisons of theory and experiment that enliven the text throughout are particularly valuable. The flavor of the book is somewhat similar to Peter Egelstaff's *Introduction to the Liquid State*, although the topics chosen are rather different. March and Tosi are well known for their work on liquid metals and the theory of the static and dynamic structure factors, and these aspects are stressed in the book.

In the Preface the authors say that the book "should be useful for established research workers in the field of the physics and chemistry of the liquid state. It should also be useful to research students entering this field." It is assumed that the reader is familiar with statistical mechanics and quantum mechanics. The book will be of particular value to those researchers involved in radiation-scattering studies of liquids, or the theory associated with such measurements; in fact the authors assume that the reader is equally at home in both k- and r-space.

Theoretical concepts are introduced by using physical and intuitive arguments, as opposed to formal definitions; in many cases equations are stated without proof. Integral-equation methods are covered in some detail, while perturbation theory receives less attention. After discussing the application of these theories to calculations of the static structure factor, several chapters are devoted to dynamic properties, with emphasis on the Van Hove function. Of particular interest are the last five chapters, which take up topics that are seldom included in books on liquids; among these are binary mixtures, charged fluids, helium liquids, critical phenomena and the liquid surface. These chapters describe recent advances in these subjects and show their relation to the field of liquid studies in general. The chapter on liquid surfaces, for example, presents the rigorous statistical-mechanical equations for the surface tension and the density profile; of special interest is the derivation of the Triezenberg–Zwanzig expression, which relates the surface tension to the direct correlation function (unfortunately the corresponding equation relating the density profile to the direct correlation function is not given). The authors then go on to consider more approximate theories for the surface tension and the distribution functions. Some of this portion of the chapter, particularly that which suggests that the liquid surface is quasi-crystalline in nature, is now outdated in view of computer-simulation results of the last few years.

There are some minor errors and misleading statements to be found; for example, several of the curves in figures 2.2 and 2.3 are unlabeled, while on page 298 the antiquated F symbol is used for

It's the whole wide world of science teaching materials

Fisher Catalog 77 C-U. In 1,150 lavishly illustrated pages. Plus superb index, reference tables and order-forms. There's never been a catalog like it. Instrumentation, apparatus, audiovisual aids, metric materials, living and preserved materials, kits, reagent-grade chemicals, lab furniture. An encyclopedic source, covering 40 different fields in biology, earth science, chemistry, and physics. Send for your free copy today.

Fisher Scientific Company 711 Forbes Avenue Pittsburgh PA 15219 (412) 562-8300

Circle No. 37 on Reader Service Card

Helmholtz free energy. Perhaps more serious, some recent advances in liquid theory are omitted or only mentioned very briefly in passing. In the chapter on mixtures, considerable space is devoted to the original form of conformal solution theory as proposed by Hugh C. Longuet-Higgins. The more successful van der Waals 1 theory, developed by Frances E. Leland and his colleagues in the 1960's, is not mentioned. It is perhaps understandable that the authors, in the interest of keeping the size of the book within reasonable bounds, would not want to give a detailed account of the theories for molecular fluids. However, some discussion of this subject would have been very useful in view of the large number of theorists and experimentalists working on such liquids.

KEITH E. GUBBINS
School of Chemical Engineering
Cornell University
Ithaca, N.Y.

Physics in Industry

E. O'Mongain, C. P. O'Toole, eds.
595 pp. Pergamon, Elmsford, N.Y., 1976. $30.00.

This book is the proceedings of "Physics in Industry," a "first of its kind" conference. The conference was convened by the International Union of Pure and Applied Physics in Dublin, Ireland, in March 1976 to establish IUPAP's role in industrial physics research.

In the plenary session, Lewis Branscomb (US) urged full participation by industrial physicists in IUPAP; H. B. G. Casimir (The Netherlands) urged that universities maintain their independence of industry, and P. Aigrain (France) related the impact of science on product developments. In the closing discussion, C. C. Butler (UK), IUPAP president, concluded that industrial physics and physicists will receive greater attention in future meetings and commissions than they did in the past.

Eighty-five papers representing 22 countries were presented in sessions on "New Technologies," "Social Aspects," "Energy," "Communications and Data Processing," "Acoustics," and "Biological Applications." Universities contributed 60% of the papers; industry and government each contributed 20%. This suggests that there are limited opportunities for physicists in European industry. By contrast, 50% of the US papers presented came from industry.

Papers included recent developments in industry, such as magnetic-bubble memory devices, by H. P. J. Wijn (The Netherlands); thermodynamic modeling of metallurgical processes, by B. Brudar (Yugoslavia), and advances in computer technology. R. W. Hamming (US) discussed hardware and software limitations of computers; A. V. Ferris-Prabhu (US) reviewed a model for the reliability of large data-processing systems, and I. W. Pence (US) described BEAMOS, a new memory technology with improved performance compared to rotating magnet memory.

Contributions from university speakers included M. Schlesinger (Canada) on a new photoimaging process, G. Sorensen (Denmark) on plating with ion accelerators and J. T. McMullan (Ireland) on energy research in a northern maritime climate. Physics applied to agricultural research, by J. Schenk (The Netherlands), and isotope studies of flow processes, by A. J. Niemi (Finland), are positive examples where physics can play a unique role in nations searching for abundance from technological developments.

Sessions on "Social Aspects" dealt with the declining university enrollment, stabilized academic demand and unknown industrial demand for physicists. General trends in this area are similar from one country to the next. R. Fieschi (Italy) discussed the impact of politics on physics research, and J. E. Ripper (Brazil)