presented in terms of both experimental and theoretical work which sometimes leads to a disjointed discussion. F-, F_2-, F_3-, F_3^+-, F^--, H-, V_k-centers and impurity defect centers are noted. Color centers in alkali-earth fluorides and oxides and in silver halides are also described. As noted earlier, there is an ample reference list.

Chapter 2 is a pedagogical approach to vibrational perturbations of defects in ionic crystals. There is a clear discussion of the two important approximations needed in the development – the adiabatic and the harmonic approximations. Several models for calculating the density of states are presented. Theory is applied to the examples of H^- and OH^- substitutional impurities. Other examples have less detail including gap modes as found in Cl in KI and resonant modes as found in Ag^+ or Li^+ in alkali halides. Raman scattering and tunneling are introduced and examples of their uses are given.

Chapter 3 discusses the electron–vibration interaction and its effects on optical transitions associated with defect states. The basic theory of optical band shapes is presented along with examples of defects with strong and weak coupling to the lattice. The Jahn–Teller effect is covered in some detail. Defect-induced Raman scattering is treated with special emphasis on resonance Raman scattering from F centers.

Chapter 4 discusses the electronic states of defects in ionic solids beginning with the F-center in the alkali halides and continuing with the Th impurity in alkali halides. Two problems are discussed in detail; self-trapped excitons in alkali halides and non-radiative transitions. This chapter presents theory and experiment in a readable, logical sequence. Apparently, this chapter has been completely rewritten since the French version.

Chapter 5 describes the creation of color centers by ionizing radiation and very briefly discusses several applications, including X- and γ-ray dosimetry, geology, optical memories, dielectric thermometers and broadly tunable lasers. Certainly, a great deal more is known about these applications than is presented here, especially tunable lasers which are now becoming commercially available.

There are some problems with the book. There are a number of cases of incorrect English grammer which probably came about in the translation process. There are also a number of errors connected with the figures; for examples, curve (*b*) of Figure 2.5 is referred to in the text while there is no curve (*b*) in the figure, and Figure 2.14, referred to on page 139, appears to be missing. In a work of this type the references are invariably incomplete. In this case, however, enough references are given so that works which may have been overlooked will certainly be referenced in the articles referred to in the text.

This is a valuable book as a general introduction to the subject of localized states in insulators. The text is especially useful because of the extensive bibliography. I recommend it to scientists who are interested in doing research in this field or who want to apply concepts of this field to other areas.

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The molecular physics of liquid crystals. Edited by G. R. LUCKHURST and G. W. GRAY. Pp. xii + 494. London: Academic Press, Inc., 1979. Price £20·00, US $46.00.

Books on the subject of liquid crystals have been appearing at a rather rapid pace in recent years. Their appearance is a measure of the current interest in liquid crystals, which did not exist in years gone by. To illustrate the status of liquid crystals in the 1960's the reviewer refers to an article written in *Angewandte Chemie* (1966), **14**, 29 entitled *Liquid Crystals ... A Research Field of Low Return* in which the anonymous author referred to the 'Liquid Crystal Conference' called by G. Brown of Kent State University in August 1965. The author of this article writes 'the conference constitutes a gratifying indication of the renewed interest in crystalline liquids'. The author writes that it may be expected that this field, which is of interest in research and in practice, will again be taken up with greater enthusiasm. This greater enthusiasm has come to pass and a dynamic field of research is with us.

The source of material for this volume was the NATO Advanced Study Institute which met at Corpus Christi College, Cambridge at the end of August 1977. The book is written by an impressive list of scholars. There are 20 chapters and a subject index and a chemical index. The subject index is adequate but the chemical index is very limited. Since the topics covered in this book are diverse, we list the titles of the chapters and the authors as follows: (1) G. W. Gray, *Liquid crystals and molecular structure – nematics and cholesterics*, (2) A. J. Stone, *Intermolecular forces*; (3) C. Zannoni, *Distribution functions and order parameters*; (4) G. R. Luckhurst, *Molecular field theories of nematics*; (5) H. Schröder, *A molecular field theory of the cholesteric liquid crystal state*; (6) B. W. van der Meer & G. Vertogen, *A molecular model for the cholesteric mesophase*; (7) M. A. Cotter, *Hard particle theories of nematics*; (8) M. A. Cotter, *The van der Waals approach to nematic liquids*; (9) C. Zannoni, *Computer simulations*; (10) D. E. Martire, *Thermodynamics of phase transitions*; (11) D. E. Martire, *Statistical mechanics of binary mixtures*; (12) G. W. Gray, *Liquid crystals and molecular structure–smectics*; (13) A. J. Leadbetter, *Structural studies of nematic, smectic A and smectic C phases*; (14) J. Doucet, *X-ray studies of ordered smectic phases*; (15) J. Charvolin & B. Deloche, *Nuclear magnetic resonance studies of molecular behaviour*; (16) P. L. Nordio & U. Segre, *Magnetic resonance spectroscopy – static behaviour*; (17) P. S. Pershan, *Raman studies of orientational order in liquid crystals*; (18) P. L. Nordio & U. Segre, *Rotational dynamics*; (19) P. L. Nordio & U. Segre, *Magnetic resonance spectroscopy – dynamical aspects*; (20) A. J. Leadbetter & R. M. Richardson, *Incoherent quasielastic neutron scattering*.

On perusing the chapters one is of the opinion that very little new material was included by the authors. This was probably on purpose since the NATO meeting focused mostly on the idea of a school and not the idea of a research program.

G. W. Gray in his two chapters set out to relate molecular geometry and liquid crystallinity. As always, Gray writes scholarly chapters which are valuable to the organic chemist as well as to the theoretician.

Stone wrote a successful chapter surveying the theory of intermolecular forces with emphasis on the orientational dependence of the potential. Luckhurst considers theories of nematics based on the long-range part of the anisotropic intermolecular potential. Theories on the short-range components are found in chapters 7 and 8.

Several chapters discuss the cholesteric–nematic structure (often called the cholesteric). The development of a molecular model is still evasive and there seems to be considerable controversy among theoreticians on the structural model of the cholesteric–nematic. These differences of opinion were evident at the time of the school and surface in chapters 5 and 6.

Martha Cotter does a nice job of discussing the hard-core model of the liquid-crystalline state. The theoretician is still looking for a better model. Computer simulations presented in the chapter written by Zannoni point out that the problem of calculating the thermodynamic observables of a fluid from a given intermolecular potential is complex and with a few exceptional cases only two possibilities are open: (1) use of approximate theories, and (2) resorting to computer simulation. The chapter consists of numerical solutions to the problem of many interacting particles.

Martire's chapters focus primarily on the equilibrium thermodynamics of first-order phase transitions and their bearing on molecular statistical theories of mesophases. These chapters are well prepared and cover interesting material.

The remainder of the book focuses on experimental methods used in the study of liquid crystals. Structural studies of nematic, smectic *A* and smectic *C* phases are presented by A. J. Leadbetter. Immediately following Leadbetter's chapter there is a chapter by Doucet on X-ray studies of the ordered smectic phases. Both of these chapters deserve to be read by people doing serious work on liquid crystals. There are three chapters devoted to NMR spectroscopy. Collectively, these chapters give a good survey on the 'state of-the-art'.

Raman studies of orientational order in liquid crystals is a convincing presentation with well-defined concepts. The book closes with a good summary of studies involving incoherent quasielastic neutron scattering by Leadbetter & Richardson. The book is highly recommended as a good reference on selected topics of liquid crystals. It is written by a selected group of scholars and edited by two persons who have established themselves as 'first-line' researchers in liquid crystals.

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Röntgenbeugung am Realkristall. (X-ray diffraction in real crystals.) By E. BORN and G. PAUL. Pp. viii + 155. Munich: Verlag Karl Thiemig, 1979. Price DM 28.00.

The authors of this small book on X-ray diffraction (Thiemig-Verlag: *Taschenbücher*, Band 69) have attempted to give the reader a general insight into the interrelations between crystal-lattice defects and X-ray diffraction characteristics. Their theoretical treatment of X-ray diffraction by crystals is based on the kinematical theory.

In Section 1, the reciprocal lattice is introduced and the equation for the diffracted intensity by a perfect crystal is formulated. Section 2 (about one half of the book) deals with X-ray diffraction by a crystal with randomly distributed point defects (vacancies, foreign atoms in and out of the lattice points, *etc.*). This part is compiled according to Krivoglaz theory and completed by the Stokes correction method for measured diffraction profiles. Further, diffraction by crystals with superlattice and planar defects is discussed – the emphasis tending rather towards applications in mineralogy. In the next part, the existence of dislocations, as one further type of crystal-lattice defect, is mentioned without their influence on diffraction characteristics being examined. The conclusion of Section 2 is devoted to diffraction by polyatomic molecules and liquids (small-angle scattering). In the last section (Section 3) the reader's attention is directed to the fundamentals of X-ray experimental techniques as used in X-ray diffraction studies of real crystals, like the Laue method, the Weissenberg and precession methods, the powder focusing methods and the Lang and Berg–Barrett methods of X-ray topography. The treatment gives experimental details of X-ray filtration, monochromators for powder focusing cameras, X-ray detection and, for example, the X-ray diffractometer justifying procedure, too. The reviewer would have liked the above points of experimental method to have been illustrated by reproductions of the relevant X-ray diffraction photographs.

The conception of this book is based on the text of a course of lectures, as is mentioned by the authors in the *Preface*. The advantage of such a presentation is that one can easily obtain a good idea of the reasons for the diffraction phenomena that are discussed, without any use of complex mathematical formulae. In this respect, the authors have succeeded in pitching their book at the right level. A few trivial errors, for example, in equation (11), or the inconsistency in the symbols of the scalar product in equations (2) and (11), may be corrected by the reader himself. Unfortunately, however, the quality of the illustrations and diagrams does not correspond with the pedagogical approach to the theory. For instance, in Fig. 22 it is not clear whether the plotted interval of diffraction angles has the value of units, or of tenths of degrees; then, in the illustration of the spectra of X-ray tubes – see Figs. 28 and 32 – the doublet $K\alpha_{1,2}$ is not plotted; Fig. 33 does not contribute very much to an understanding of the Weissenberg method; and Fig. 52 does not give an exact scheme for the Lang topographic method.

The treatment adopted by this book partially idealizes the study of X-ray diffraction by crystals with defects. This may be because, in this book, the argument follows a path from the crystal with some defined type of defect to the diffraction effect, without illustrating the reverse path, by showing experimental results. Furthermore, in the reviewer's opinion, the omission of the dynamical theory of diffraction, in the case of diffraction by perfect crystals and for the consideration of X-ray topogram contrast, is disadvantageous.

From this brief outline, it should be clear that this pocket volume may serve as a first introduction to theoretical models of crystal-lattice defects, their influence on diffraction properties, and corresponding methods. For students and