Pp. 16–17: In the definition of the concept of a crystal system the following claim is made:
'However, for any **Q**-class **C** there is a unique holohedry **H** such that each f.u. group in **C** is a subgroup of some f.u. group in **H** but is not a subgroup of any f.u. group belonging to a holohedry of smaller order.'

This statement is correct from dimensions 1, 2, 3, and 4. However, it follows from the results of Plesken & Pohst that there is a counterexample to it in seven-dimensional space.

To formulate the definition of 'crystal system', the authors of the book use the intersections of **Q**-classes and Bravais flocks as introduced on p. 17 and they define the classification of the set of all **Z**-classes into crystal systems as follows:
'*Definition*: A crystal system contains full geometric crystal classes. The **Z**-classes of two (geometric) crystal classes belong to the same crystal system if and only if these geometric crystal classes intersect the same set of Bravais flocks of **Z**-classes.'

The book clearly demonstrates the variety and complexity of crystallographic groups in four dimensions in comparison with lower dimensions. In four dimensions there exist point-symmetry operations of orders 5, 8, 10, and 12; nonsolvable groups occur as point groups; the centered hypercube has higher symmetry than the primitive hypercube; non-symmorphic space groups, other than $P\bar{1}$, exist, containing only translations and point-symmetry operations; the difference between crystal system and crystal family becomes much more apparent, *etc*. Therefore, the description of the four-dimensional crystallographic groups provides a better insight into dimension-independent crystallographic properties and, thereby, a deeper understanding of crystallography in two and three dimensions.

The book may be of interest to crystallographers, physicists and chemists, as well as to mathematicians, whom the last section of Chapter I and the Appendix are meant to attract.

The reference list cites 112 names.

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Acta Cryst. (1980). A**36**, 332

Disorder in crystals. By N. G. PARSONAGE and L. A. K. STAVELEY. **International series of monographs on chemistry.** Pp. xxviii + 926. Oxford: Clarendon Press, 1979. Price £28·00.

This book is a good survey of the present knowledge of many aspects of disorder for a great selection of stoichiometric crystalline substances; the problems of defects, defect structures, and their order–disorder transformations are therefore not included. The book deals with three kinds of disorder: positional disorder, orientational disorder and magnetic disorder.

The book has twelve chapters, each with a detailed list of references. The short introduction provides some definitions. By disorder of position is meant, as one type, that the lattice is one in which there are more sites to accommodate a particular kind of particle than there are particles of that kind available and that there is some randomness in the way in which the particles are distributed among the sites in question (but nothing is said about such problems as distribution coefficients or site preferences), and, as another type, that there are N A atoms and N B atoms which together occupy $2N$ sites in a partially or wholly random way. Not included are problems of polytypism and OD structures. Orientational disorder can arise when diatomic or polyatomic molecules or ions have access to different orientations in the crystal lattice which are distinguishable. Magnetic disordering is a disordering of the orientations of magnetic spins. While the crystal may have to pass through more than one transition to reach a completely ordered state, these order–disorder transitions are also discussed but only in connection with the special examples and not in a general or complete form.

Two chapters deal with the theoretical background. The classification of transitions, ferroelectrics and antiferroelectrics, and hysteresis phenomena are discussed in terms of thermodynamics. Much attention is devoted to statistical mechanics, especially to the Ising model, its solutions and its general applications to order–disorder systems. The next chapter is a review of the more important experimental methods, such as thermodynamic studies, diffraction methods, NMR, IR and Raman spectroscopy, neutron scattering spectroscopy and other spectroscopic techniques (NQR, ESR), and dielectric properties.

The following chapters deal with detailed results on many examples: alloys; positional disorder in inorganic compounds; orientational disorder in salts, ice and hydrates; disorder in molecular solids, clathrates and channel compounds; and magnetic systems. Here, one can find a lot of detail on the disorder problems of many substances – but not of all, for example, the interesting case of minerals. The text is completed by many instructive figures and tables. There is a substance index and a subject index.

The book is written by two chemists engaged in research work in this field. It gives a detailed survey of modern knowledge of the field of disorder in crystals and is recommended for chemists, crystallographers, physicists and material scientists who are interested in order–disorder problems and phenomena in a general or special way.

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Acta Cryst. (1980). A**36**, 332–333

Phase transitions in solids. By C. N. R. RAO and K. J. RAO. Pp. 330, Figs. 168, Tables 20. Maidenhead, England: McGraw-Hill, 1978. Price £18·15.

There are at least two common approaches to the subject of phase transitions. On the one hand, the emphasis may be on a theoretical understanding of critical phenomena where terms such as order parameter, critical exponent, model Hamiltonian and (in recent years) renormalization group abound; very sophisticated mathematical techniques are used and the average research worker can often have difficulty relating the theory to real physical situations. On the other hand, the emphasis may be largely phenomenological, concerned for example with the geometrical relationships between phases in martensitic transformations or relying on semi-empirical theories to describe phenomena such as spinoidal decomposition.

Both these approaches are exemplified in this book. There are chapters on thermodynamics and statistical mechanics which clearly describe such basic ideas as Landau theory and the Ising model and, indeed, include a brief (three-and-a-half page) introduction to the renormalization group. There is also a long chapter (equivalent to nearly a quarter of the book) entitled *Various kinds of phase transitions* which describes phenomenologically, and with reference to many examples, nucleation and growth theory, martensitic transitions, order–disorder transitions, spinoidal and eutectic decompositions and transitions in glasses, liquid crystals and organic solids. Other chapters (there are seven altogether including an introduction) discuss crystal chemistry and the role of soft modes in phase transitions, and the final chapter, entitled *Properties of solids and phase transitions*, discusses magnetic crystals, metal–insulator transitions and ferroelectricity. Thus practically every topic with which a research worker in the field should be familiar is discussed in greater or lesser detail and this book is certainly a valuable introduction to the subject and should be of particular help to graduate students. Moreover it contains over 800 references to the literature through which a more detailed study of most of the topics discussed could be made.

What this book does *not* do, despite the authors' stated intention, is to provide a unified presentation of the subject. Various theoretical approaches, for example the Landau and Tizza theories of second-order transitions described in chapter two, are discussed without any attempt to relate them to each other or even to define their respective areas of applicability. The renormalization group may still have little to tell us about martensitic transitions, but it has greatly enhanced our understanding of ferromagnetism and some of the properties of soft modes. However, this theory is not mentioned in either of these contexts. Some of the arrangements of topics are also rather surprising: ferromagnetism could well have been discussed along with other *various kinds of phase transitions* in chapter 4, rather than not being mentioned until the last chapter; there would seem to be no logical reason for discussing ferroelectricity twice in widely separate chapters (using a different system of units each time) and it is certainly wrong to give the impression that the Landau rules governing the symmetry relations between different phases are particularly relevant to ferroelectrics rather than being generally applicable to any continuous structural phase transition.

Nevertheless this book is a very valuable description of the many aspects of the theory of phase transitions and should certainly be read if only to challenge research workers to work towards a more general unified understanding of the subject.

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Acta Cryst. (1980). A**36**, 333

Synchrotron radiation: techniques & applications (Topics in current physics, No. 10). Edited by C. Kunz. Pp. xvi + 442. Berlin, Heidelberg, New York: Springer-Verlag, 1979. Price DM78.00, *ca* US $42.90.

With the rapidly increasing attention being given by crystallographers to the advent of synchrotron radiation sources, this book is a very useful overview of the present situation.

There are seven chapters written readably, if rather tersely, by nine authors (from Germany, USA, Japan and the UK); line diagrams are plentiful and clear, and there are well over 1000 references to the original literature. The first two chapters give the detailed physics of synchrotron radiation, its properties and the devices used to generate it. The rest of the book deals with the range of applications of the radiation: spectroscopy receives by far the greatest coverage; however, some ten pages are devoted to experiments in the X-ray range, including four pages on topics involving X-ray diffraction.

The 'present situation' is, of course, developing very rapidly. Thus, plans are already being seriously worked out for the building of a 'European' synchrotron facility, larger and better than any of those mentioned in this book. Whether all the dreams of the enthusiasts will be realized is hard to say but, in the meantime, for those who want to know what synchrotron radiation is, and what it is mostly used for, this book is good reading.

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Acta Cryst. (1980). A**36**, 333

Optical crystallography (5th edition). By E. E. Wahlstrom. Pp. 488. Chichester, England: Wiley, 1979. Price £12·00.

Wahlstrom's book is by now well known to all crystallographers. First published in 1943, it has been with us, in successively improved editions, for over 35 years. The edition previous to the one now being commented upon was published in 1969 and a fairly detailed review was published then in this Journal [Woolfson, M. M. *Acta Cryst.* (1969), B**25**, 2422 or (1970), A**26**, 167]. That review concluded with the remark that the book was highly recommended to all crystallographers.

This fifth edition is at least as good as its predecessor of ten years ago and, to all appearances, better. The style of production, lay-out and clarity of headings are all noticeably up-graded; in particular, the diagrams, previously lavish and excellent, are better than ever. The only important thing that has not been included is the use of colour pictures, which is a real loss for such a subject as optical crystallography; but of course, colour would have rendered the book more expensive. At £12, relative to today's prices, it is a bargain.

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