There are other chapters that similarly will serve mostly as interesting reading rather than as an important reference source. The chapter on glass making, for example, describes the making of window glass in some detail (including the exciting float process), but does not give a really full picture of modern methods for producing optical glass. It would have been better in the discussion of glass properties to have played down the optical characteristics of interest to the lens designer and to have emphasized the mechanical, thermal and chemical properties of glasses and other optical materials that actually affect (and often seriously) the working behavior in the shop.

I hope that this book will be commercially successful to the degree that revisions and new editions will be possible. Expansion of the index will make the book easier to use as a reference. Extension of the sections on optical glass, nonspherical surfaces, optical crystals and metals, testing and lens mounting could convert these from interesting commentaries to definitive reference sources. The addition of a chapter with expanded information on plastic-lens manufacture would also be of real value.

A short chapter on production planning gives useful insight into some of the practical problems of cost estimation and work-flow organization. Short chapters on optical fibers and projection screens are interesting, but hardly seem central to the major topic.

This important book should be in the library of anyone with a serious interest in the making of optical surfaces.

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Magnetic Interactions in Solids

H. J. Zeiger, G. W. Pratt
660 pp. Oxford U.P., New York, 1973. $62.50

Over forty-two years have passed since J. H. van Vleck, in the preface to his celebrated *Theory of Electric and Magnetic Susceptibilities* wrote that the successes in the theory of susceptibilities may be regarded as among the greatest achievements of quantum mechanics and devoted his book to that topic. In the intervening years so much progress has been made in understanding quantum mechanics and statistical mechanics of solids in general, and magnetic solids in particular, that this statement of van Vleck now sounds quaintly dated. Yet here we have a new and learned volume, *Magnetic Interactions in Solids*, by two able researchers at MIT's Lincoln Laboratories, Herbert J. Zeiger and George W. Pratt, reading for all the world like an update of the earlier book. It is in fact a new classic, impeccably written, delving in areas that are well known now and perhaps even beyond controversy, but doing so with method and clarity. It is a shame that so little of it deals in the cooperative aspects of magnetism, the quantum mechanics and statistical mechanics of the interacting spins, the nature of spin waves, or of phase transitions, or quantum dynamics of strongly interacting electrons.

Yet it is in the nature of such a "classic" to remain on safe ground, to skip areas of recent discovery and controversy, and the authors have consciously exercised their option to avoid this rocky terrain. Their preface is addressed precisely to this point: "Our original intent was the preparation of a book on the physics of ordered magnetic systems. In the course of collecting material for this, we found that the presentation of background material alone was a formidable project. We therefore chose to present a more basic treatment of magnetism, tracing the origins of magnetic interactions in insulators and metals, and leaving to others the task of discussing ordered magnetic systems."

The contents of the Zeiger–Pratt book are as follows: after introductory chapters in which the origins of electronic magnetism are sought in the Dirac equation, in which the hyperfine interaction, spin-orbit coupling, the g-factor and the Zeeman effect are all obtained, the many-electron atoms are studied by means of the Hartree–Fock approximation, followed by an explanation of the L–S and J–J coupling schemes, a derivation of Hund's rule and quadrupole moment operators. Similar material is also found in countless quantum-chemistry texts (also known as atomic or molecular physics), but it is necessarily repetitive, because a consistent notation and terminology is introduced.

One of the main chapters follows, more than 150 pages on magnetic properties of ions in the fields of a crystalline solid. This well presented survey of the influences that a solid-state environment can have on an incomplete-shell ion is enhanced by the use of tables, figures and computational examples. A good example of the presentation is the Jahn–Teller effect; a word picture is first drawn, distinguishing between the static and dynamic effects. This is followed by examples, calculations and figures of constant-energy contours. This chapter also includes some 30 pages on the exchange forces in insulators: The Goodenough–

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Kanamori rules and the phenomena of double-exchange. This important chapter thus ties in with the atomic theory developed earlier.

The remainder of the book is devoted to solid-state theory. There is a development of band structure, with or without applied fields, effective mass theory, various kinds of resonance and even slight digressions to the polaron (treated by perturbation theory). There is a chapter on semiconductors, and one on metals, in which the topic of magnetic impurity states is reviewed. These chapters, dealing with relatively recent topics are reasonably well self-contained, but also well annotated and referenced for further study. This concludes the material in the main part of the text, but a number of more theoretical topics such as angular momentum, perturbation theory, quantization, density matrix are left to the voluminous appendices.

Altogether, the text presents only the basic elements of the phenomenon of magnetism in the solid state. This thorough presentation is suitable for graduate students in theoretical or experimental solid-state physics and in quantum-chemistry and as an excellent reference text in the laboratory. Only the price tag will undoubtedly limit its dissemination.

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Methods of Experimental Physics, Volume 10: Physical Principles of Far-Infrared Radiation

L. C. Robinson
460 pp. Academic, New York, 1973.
$29.00

The part of the electromagnetic spectrum between the infrared and the microwave regions has attracted much attention during the last two or three decades. Intensive development has resulted in extending optical techniques into the far infrared, and microwave techniques into the millimeter and submillimeter wavelength regions. In recent years books discussing the spectroscopic aspects of the far infrared, millimeter and submillimeter spectral regions in great detail, have appeared.

Physical Principles of Far Infrared Radiation appears as volume 10 of the series "Methods of Experimental Physics." L. C. Robinson, treats under this title both the extension of optical techniques into the longer wavelength region, and those methods which are an outgrowth of microwave techniques into the submillimeter and millimeter wavelength regions. To these latter techniques the book pays considerably more attention.

The generation and detection of far infrared radiation and the transmission of waves and transmission systems are presented in three chapters. In the chapter on generation of far-infrared radiation, there is a presentation of some of the recent techniques such as the use of a tunable laser, solid-state laser diodes and the Josephson junction as wave generator. Also included is a section on gas lasers (with a table of laser lines), harmonic generation, electron tubes and some other techniques. The presentation is given with many details without appearing lengthy. The chapter on detection of far-infrared radiation presents all important methods. We find a discussion of thermal and photoconductive detectors of various kinds, as well as point-contact diodes and the Josephson junction. The last section includes a detailed discussion on noise.

The third chapter on wave transmission and transmission systems treats at the same time the physical methods of frequency analysis of radiation as well as the transmission properties of materials. We find a discussion on grating spectrometers and a short discussion of Fourier-transform spectroscopy without treating phase error corrections or the operation in the asymmetric mode. The Fabry–Perot properties are discussed in several sections, as needed, but no mention of multiple-layer interference filters is made. Also included are discussions of all kinds of filters, including transmission and reflection properties of various materials, metallic reflection, waveguides, light pipes, polarizers and a millimeter wave spectrometer. It would have been preferable if the author had separated the treatment of the physical methods of frequency analysis from the "transmission properties of matter." The former deserves a much more systematic treatment than presented here.

The remaining three chapters contain discussions of applications. One could argue that applications do not belong in a book devoted to "principles," but one would go along with some for demonstrative purposes. With this point of view it is understandable that the author selects subjects close to his own activities. Two chapters included are "Cyclotron Resonances with Free Electrons and Carriers in Solids" and "Wave Interaction in Plasmas." These two chapters add much to the usefulness of the book. Most subjects presented here are discussed in other books in this field in far less detail, if treated at all.

The last chapter is devoted to the spectra of gases, liquids and solids and could have easily been omitted without