mains do exist is probably surprising to many even today, though the stability of these domains was reported in 1960 by Kooy and Enz of Philips Research Laboratories in Eindhoven. It was not until it was realized that magnetic bubbles could operate competitively at speeds between those of magnetic tape and disk systems on the one hand and core or semiconductor memories on the other that a memory technology based on them emerged. Many interesting physics problems surfaced as this technology advanced, "hard bubbles" being one example.

Magnetic bubble domains can be readily observed in orthoferrite and garnet platelets and in epitaxial garnet films. In fact, observation of bubbles in controlled motion performing logic and storage functions is one of the fascinations of this technology. As a result of this ease of observation, the understanding of bubble circuits has progressed rapidly. The physics of bubble manipulation is adequately covered by O'Dell.

Tens of thousands of magnetic bubbles a fraction of a micrometer to several micrometers in diameter are entered as binary storage patterns in chips several millimeters on a side. These chips, singly or in combinations, are packaged to provide memory in many systems. *Magnetic Bubbles* will provide the casual reader with an overview of the subject and permit him better to compare magnetic bubble storage with other contenders. It is written in sufficient depth to satisfy the more serious student of bubble behavior.

A. H. BOBECK

Bell Laboratories,
Murray Hill, New Jersey

Solid State Spectra

Optical Properties of Ions in Solids. Papers from a NATO Advanced Study Institute, Erice, Italy, June 1974. BALDASSARE DI BARTOLO and DENNIS PACHECO, Eds. Plenum, New York, 1975. xvi, 494 pp., illus. $39. NATO Advanced Study Institutes Series B, vol. 8.

The electronic energy states of ionic defects in solids have long been of immediate practical interest in the technology of artificial light sources: phosphors, fluorescent materials, and most recently lasers. The development of narrow, intense light sources has in turn accelerated the study of the defects themselves by, for example, enhancing their sensitivity as probes of the vibrational states of the host material. With their relatively simple structures, ionic defects have served as a rich microscopic "laboratory" for the imaginative application of quantum mechanics to their vibronic states and to mechanisms such as cooperative absorption and transfer. The present volume gives a clear picture of the current status of this aspect of the field.

Well-done physics summer school proceedings serve to fill the gap between what is learned in general quantum mechanics courses and the detailed knowledge needed today for research in the subspecialties of physics. This gap has become virtually unbridgeable by specialty graduate courses such as those in solid state or nuclear physics, unless they are much too narrowly focused. The Erice volume is suitable as a basis either for a subspecialty course or for self-study by a graduate or advanced undergraduate student.

The optical properties of ions are discussed in many approximations, as appropriate, from the simplest configuration-coordinate picture to a full treatment of phonon sidebands. Chapters on magnetic insulators, the Jahn-Teller effect, and ion-pair spectra are included. The important related subjects of stepwise up-conversion and cooperative absorption phenomena are covered, and this reviewer is especially enthusiastic about the clarity of the treatments of energy transfer by Watts and Orbach. All the lectures are concerned primarily with theory, but illustrative spectra are included and the balance is more than adequate. The value of the book is enhanced by the inclusion of just the right proportion of relevant more general topics such as semiclassical radiation theory, phonon theory, and group theory.

The authors of the lectures published in full are B. Di Bartolo, D. Curie, T. L. Estle, D. S. McClure, L. Mehrkam, R. Orbach, R. K. Watts, and F. Williams. Many of them have contributed more than one lecture. The authors and editors have produced a uniformly well-done volume that should have a place in many programs of study in the field.

ROBERT S. KNOX

Department of Physics and Astronomy,
University of Rochester,
Rochester, New York

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