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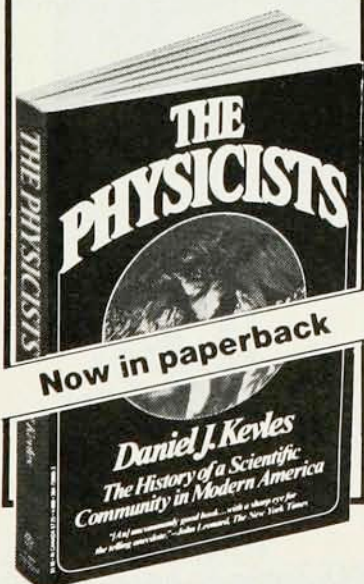
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well as in application. The driving force of the progress comes from the need for thin-film technology by the electronics industry. The demand for a faster speed and denser packing in microelectronics has now prompted many scientists to study the fabrication of submicron thin-film structures and their unique properties. How to examine these structures has also provided the thrust to develop microanalytical techniques for greater sensitivity and multiple analytical capabilities. The recent formation of a "Thin Film Microstructure Science and Technology" subcommittee in the National Science Foundation is an indication of the significant progress in the thin-film field.

Thin film covers a wide range of disciplines and applications (materials science, electronics, surface science and solid-state physics), and shows a strong interplay between science and technology, as illustrated by the example of thin-film contacts to semiconductors.

In such a fast developing and vast field, it is crucial to be able to grasp the basic phenomena and fundamental principles. With this viewpoint, I welcome the publication of *Physics of Thin Films* by Ludmila Eckertová of Charles University, Czechoslovakia. The book is of medium size (254 pages). We should congratulate Eckertová for attempting to emphasize physics in the thin-film field; nevertheless her accomplishment is unsatisfactory.

The outline of the book is conventional. It starts with film preparation and formation, then thickness and microstructure measurements, followed by properties of thin films (mainly mechanical and electrical) and finally application of thin films. Among the various topics, I found the sections on thin-film nucleation and transport properties more informative than the rest. For example, Eckertová points out on page 31 that deposition variables such as residual-gas pressure, evaporation rate, and temperature and structure of the substrate are important in producing films with reproducible properties. She gives detailed discussions on how each of these variables affect thin-film structure and composition. In general, thin-film properties are strongly affected by microstructure, and hence the transport property of thin films is more complicated than that of bulk specimens because of microstructure dependence. Eckertová discusses the correlations to surface scattering, thickness, grain size, and discontinuous films.

On the other hand, the book contains a very limited treatment of some current topics on thin films, and no mention at all of interfacial reaction and diffusion in thin films, which are at present very active areas. Also, Eckertová makes no mention of Rutherford backscattering technique, which can be used to measure film thickness, especially the intermetallic layers in

thin-film reactions, although she has devoted a chapter to a discussion of thickness and deposition-rate measurement methods.

Overall, I feel Eckertová has not given enough attention to the unique structure-property correlations in thin films, which is needed in order to bring out the science from the field or to bring more physics into it. Finally, the book contains many printing errors; I found at least ten.

KING-NING TU

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Detection of Optical and Infrared Radiation

R. H. Kingston

140 pp. Springer-Verlag, New York, 1978.
\$18.80

The field concerned with the detection of optical and infrared radiation has grown rapidly during the past decade. Advances have been spurred on by considerable success of applications in a variety of diversified fields encompassing research areas in astronomy and medicine, military applications such as reconnaissance and communications, and commercial applications ranging from non-destructive testing to weather forecasting and a search for natural resonances. Despite these broad ranges of applications, one finds few courses in academic institutions devoted to the field. Much of the training is obtained "on the job" or in concentrated minicourses, usually of one-week duration, at institutions such as the University of Michigan or the University of California at Santa Barbara.

While a number of books have been written in the field, most are reference books not especially suitable as texts. Robert H. Kingston wrote his recent text with the student in mind. At the beginning of each chapter, he states clearly what he intends to accomplish and why. At the end of each chapter, selected problems give the reader an indication as to whether he has digested some of the material studied. The book is well written, brief and to the point. Derivations are clear and references are adequate. It is quite apparent that the text has been tried out in a course, before Kingston wrote it in final form.

Contrary to expectations, as one sees the title, Kingston gives no lengthy discussion of various types of infrared detectors and their characteristics. He points out that there are sufficient books on that subject already (see, for example, *Optical and Infrared Detectors* edited by R. J. Keyes and reviewed in *PHYSICS TODAY*, October 1978, page 64). Kingston instead treats "the fundamen-

tals of optical and infrared detection in terms of the behavior of the radiation field, the physical properties of the detector and the statistical behavior of the detector output."

The book begins with the derivation of the Planck radiation law. It covers ideal photon detectors, thermal detection processes and heterodyne detection and various applications such as radiometry, stellar interferometry and laser radar. While Kingston does not specifically cover detector materials, he discusses in detail photoconductors, photodiodes and avalanche photodiodes. By using material parameters for HeCdTe, as an example, he employs the formulation he has developed to calculate the device characteristics. He uses a similar treatment for thermal detectors, where he treats the most common types: bolometers and pyroelectric detectors. The detection of radiation requires an understanding not only of the source of radiation and the detector but also of the medium between the two. With that in mind, there is a chapter on atmospheric limitations with emphasis on turbulence.

Perhaps another author might have stressed different topics or given more detail on the experimental techniques and equipment. There is no doubt, however, that this book meets a real need. One can hope that it may spawn courses at a number of universities where this book might be used as a text, or that this text might lead to others using different approaches.

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Induced Representations in Crystals and Molecules: Point, Space and Nonrigid Molecule Groups

S. L. Altmann
369 pp. Academic, New York, 1977. \$35.25

A representation of a group may be created or induced from a representation of a subgroup. Induced-representation techniques are a standard part of most introductory texts on group theory and a very useful tool in applications of the theory of groups to physical problems. To show that an induced representation is irreducible can be a tedious or difficult task.

In the early 1950's George Mackey proved a series of powerful theorems elucidating the properties of induced representations. Mackey's work in turn has stimulated applications and extensions in many areas of theoretical physics including the book that is the subject of this review. Indeed, the heart of the

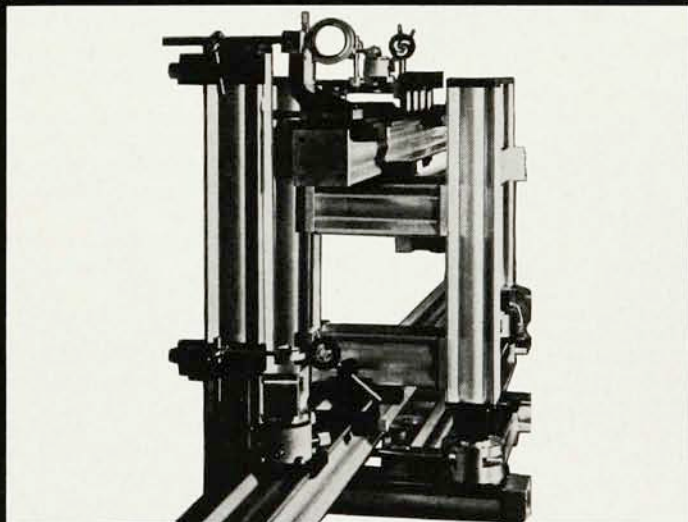
theoretical development of Simon L. Altmann's *Induced Representations in Crystals and Molecules* is chapters 13 through 16. This section begins with a theorem credited to Mackey, but specialized for finite groups by Christopher J. Bradley. Mackey's theorem and its extensions lend a laudable elegance and economy to the theoretical development and in this respect do provide fresh insight into group structures. Judging from Altmann's book, however, the promise of significant new results stimulated by Mackey's work remains unfulfilled. The

induced representation language has not produced any general theoretical results unobtainable in other ways.

Induced Representations in Crystals and Molecules is an advanced group-theory text intended for graduate students and researchers in solid-state physics and theoretical chemistry. The organization of the material and the manner of presentation benefit from Altmann's experience in lecturing to various groups. It is not a book for novices in group theory. The novice will find little to help him understand where a

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