strong research interests in the field, and in recent years their work has included studies in ion implantation, sputtering, electron passage through matter, thermoluminescence, and channeling and atomic collisions in solids.

The book begins with a discussion of direct observation of point defects or defect clusters using magnetic and optical properties including luminescence, thermoluminescence and photoconductivity. The authors discuss extended defects, dislocations and grain boundaries along with indirect methods of defect observation such as internal friction and ionic conductivity. Then specific defect models and defect formation are covered. The book ends with a unique chapter on defect applications, which, in these days of relevance, should prove a useful resource for anyone seeking justifications for basic research in the field.

The authors' approach is primarily descriptive and the book has a strong empirical flavor. This has the advantage of allowing the authors to cover a large number of phenomena in various materials in a short space. However, its weakness is that experiment and theory are not well integrated. Formulas are not always related to specific models and are often introduced without derivation, even when that could be done with the tools available to the undergraduate. Although the reader is assumed to have mastered a course in solid-state physics, this leaves many phenomena inadequately related to general principles for much of the intended audience. This shortcoming is particularly apparent in the description of magnetic resonance experiments in the second chapter. The treatment is so brief that students unfamiliar with the methods would get little out of the readings. However, these defects could be easily remedied with supplementary lectures or by some collateral reading in the numerous references supplied at the end of each chapter.

The book has a very good range of coverage, includes a great deal of up-to-date material and is well illustrated. It appears best suited for a special topics course and as a source for those preparing undergraduate and lower-level graduate courses. The text may be read rapidly and serves as a quick up-to-date orientation in the field of defects in insulators and semiconductors. It is, however, not a book that ties up all the loose ends. Rather, it is somewhat like a research paper which encourages the reader to fill in blanks and delve further in the literature.

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Space and Time in the Microworld

D. I. Blokhintsev
330 pp. D. Reidel, Dordrecht, Holland, 1973. $39.50

In this book D. I. Blokhintsev, an elementary-particle theorist, presents a survey of approaches to the problems of geometry and causality at very small distances, which includes his own contributions to these subjects.

Starting with geometric measurements in the microworld and in the macroworld, he goes over to discussions of how to perform meaningful measurements if special relativity is taken into account, including the positive energy requirement. He discusses the roles of finite size, of form factors and of elementary particles, and then goes on to the concept of causality in quantum theory. He finishes up by discussing possible generalizations of causal relationships and of geometry at levels below the dimensions of the Bohr atom.

In several places the author is briefly commenting on the possible contribu-

tions of general relativity, but obviously his own research experience and thinking are centered primarily on special-relativistic theories and models. Models of quantum space-time are discussed, and very lucidly; but here also one feels that the author's heart is not quite in this type of approach.

Blokhintsev himself appears to have thought primarily in terms of models in which the isotropy of space-time, that is to say the complete Lorentz invariance, is modified at the microscale by the introduction of a local preferred time-like vector, which might be either internal to a given process or externally contributed by the large-scale-structure of the universe. We know that the actual universe in which we live involves everywhere such a preferred time direction—that is to say the prevailing state of motion of the galaxies in our cosmic vicinity. It is not entirely clear how the motion of these very large (but very distant) masses affects processes at the level of elementary-particle reactions, but one ought not to exclude such possibilities merely on the grounds that right now they appear unintuitive.

The present English version of the book is marred by poor mechanics. There are many evidences of careless translation and poor editing, including sentences with incomprehensible grammatical structures. There is no index, an omission that is particularly disappointing in a book that surveys other people's work. There is, however, a list of references, amounting to almost 150 items. This list might provide access to articles written by Soviet authors that might otherwise have escaped the attention of a Western reader.

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Crystallographic Groups

T. Janssen
281 pp. Elsevier, New York, 1973.
$21.00

Group theory has always had a special esthetic appeal to the theoretical physicist. This appeal arises from the fact that its subject matter is exact, perfect and flawless. It makes no concessions and does not allow any approximation, either subtle or gross, to creep into its "crystal"-pure material.

The study of the basic symmetries of nature is one of the main pillars of theoretical physics; in particular, solid-state physics involves a "great variety of very rich symmetries" that have challenged the imagination of many a writer for several centuries. In the