Semiconductor Device Physics. ALLEN NUSSBAUM. Pp. 340, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1962. Price $11.00.

During the past eight years, several books have appeared whose purpose was to explain the basic principles of semiconductor devices for the benefit of engineers concerned with their development or use. Often, the discussions have been oversimplified to the point where the material is all but unrecognizable to a solid-state physicist, and in some cases one finds half-truths and misconceptions. It is a great pleasure to report that, at last, we have an expository book (part of the Prentice-Hall International Series in Electrical Engineering), which gives something like an adequate discussion from the standpoint of the physicist.

The author takes on a very ambitious program, since according to the preface the reader is expected to have only a knowledge of mathematics through elementary differential equations, and a "first-year college physics course including a nonmathematical introduction to atomic physics." Accordingly, the first two chapters attempt to explain quantum theory and statistical mechanics—all in 70 pages! These chapters are well written, and are at an amazingly high level for a book of this kind; but the reader who has no more background than listed in the preface will find them rough going. There is no help for this—just as, twenty years ago, electrical engineers suddenly found that they must go beyond ac circuit theory and learn Maxwell's equations, so today they must again expand their horizons to include quantum theory and statistical mechanics.

Chapter 3 is a preliminary discussion of energy bands and carrier statistics, which prepares the way for the basic discussion of pn-junctions in Chapter 4. In Chapter 5 we return to the general theory of periodic structures and energy bands. While in most expositions of this type, the reader is hardly made aware of the existence of any lattice other than simple cubic, we find here a full treatment of the 32 crystallographic point groups and the 14 Bravais lattices, lavishly illustrated with helpful diagrams. The figure illustrating bilateral symmetry is particularly interesting and informative, in spite of a slight flaw which results in the symmetry plane of the upper portion being rotated approximately 30 degrees (the essential points can still be seen if this rotated portion is blocked off). The chapter concludes with a detailed analysis of band structure in tellurium, germanium, and silicon.

Chapters 6 and 7 develop the fundamentals of irreversible thermodynamics and transport theory, at the phenomenological level represented by the Boltzmann equation. In view of the fact that the Boltzmann equation is only an approximation, probably not adequate for quantitative treatment of transport phenomena in any system other than a dilute gas, some attention to fundamentals (i.e., the Liouville equation) might have been appropriate here, even though we have not yet succeeded in carrying out calculations with the full Liouville equation. The concluding chapter applies this material to a discussion of resistivity, thermoelectric effects, scattering, mobility, and minority-carrier lifetime.

All in all, the book is, in this reviewer's opinion, by far the best exposition of this field yet produced. It can be recommended enthusiastically to engineers who want to learn the basic physics behind their solid-state electronic devices in a way that is sound and not watered-down; and also to physicists who want to understand how recent advances in solid-state physics are being applied in modern technology, from an author who does not insult their intelligence by oversimplifying.

E. T. JAYNES
Washington University