tensive variations. The chapter concludes with an excellent summary in which it is shown that the many vector integration formulas are all special cases of three basic tensor integral transformations.

Having developed the elaborate machinery in Chapters 1–5 the author devotes the next three chapters to three applications of these established results, namely, dynamics, fluid mechanics, and electrodynamics. The five earlier chapters are so carefully planned, and the results so excellently stated, that the applications are developed neatly, concisely, and with a minimum of effort. In this respect the book is excellent. However, unless the reader is already familiar with the basic principles of dynamics, fluid mechanics, and electrodynamics, he will be unable to appreciate the organizational structure of the book which leads so naturally to a clear elucidation of these fundamental applications.

Chapter 9 is divorced from the remainder of the book. In this chapter the author axiomatically defines what is meant by a vector space over a field and discusses some of the elementary properties of vector spaces. Since this algebraic concept enters into most branches of modern applied mathematics it is gratifying to find even a brief introduction to this subject in a book dealing with what is usually referred to as a classical discipline.

The book is excellently provided with illustrative examples and problems. The examples complement the text and range from an elegant formulation of Desargues' Theorem, Ceva's Theorem, and Pascal's Theorem in Chapter 1, to a discussion of the magnetostatics of certain geometrical configurations in Chapter 8. Each chapter is provided with several short sets of problems, and answers to the problems are listed in the back of the book.

This reviewer found several points in the exposition which could be subject to criticism. Some of these are cited below together with a few of the more glaring typographical errors:

1. As noted in the index, the definition of the term "basis" occurs on p. 37; however, the term is first used on p. 31.
2. In Chapter 1 the symbol ($\vec{u}$, u_0) denotes a straight line. In Chapter 2 the same symbol denotes a line vector.
3. The term "cycl" first appears in a hint in Problem 17, §11, Chapter 1, but this term is never explained. It also occurs later in the text with no explanation.
4. The term "weighted centroid" is used in §7 of Chapter 1 without being previously defined. It may not be clear how this term differs from a centroid.
5. If P is a dyadic, it is never explicitly stated what is meant by the product $\vec{u}\cdot P$, although some vague hints are given.
6. Although the term "double layer" is defined, the term "single-layer" is used in §82, Chapter 8, without being previously defined.
7. In §97, Chapter 9, the author promises to prove that $U + V$ is a vector in Hilbert space, when U and V are elements of Hilbert space. He never does so explicitly, although the machinery is developed.
8. In Figure 2a, the letter "D" is missing.
9. In §67, Chapter 7, equation (53.3) should read "W_1" instead of "W".
10. In §88, Chapter 9, property A_4 is incorrectly stated.
11. There is a confusion in subscripts in the statement of Theorem 1, §97, Chapter 9.

In conclusion, the organization of the book, with the possible exception of the superfluous Chapter 2, is so outstanding that it far outweighs any of the minor flaws cited above. The book is strongly recommended.

Thermodynamics: An Advanced Treatment for Chemists and Physicists (3rd Revised Edition). By E. A. Guggenheim. 476 pp. (North-Holland, Holland) Interscience Publishers, Inc., New York, 1957. $9.75. *Reviewed by Harold W. Woolley, National Bureau of Standards.*

In its third edition, this valuable reference book and text has been improved further by several changes. The treatment of mixtures has been made more unified and the topics covered have been extended into the field of the thermodynamics of irreversible processes. The author of this book does not claim completeness of coverage of all topics touched on. Instead, there has been judicious choice of items of principal interest to both chemists and physicists in the broad field comprising physical chemistry.

In a presentation emphasizing the logical application of fundamental principles, there may be less emphasis on the spirit of adventure than some experimentalists feel necessary to be consistent with the original development of the science. Professor Guggenheim has given references to many of his original scientific contributions, however, to which one may turn for examples of such developments. Though it may appear to some experimentalists that this is primarily a theorists' book, there are actually numerous examples of quotation of experimental data and comparison with theoretical indications. This reviewer considers it quite proper that the subject of thermodynamics be presented as a mathematically exact discipline and considers it appropriate to possess a copy of so excellent a book prepared on this basis.

Vector Spaces and Matrices. By Robert M. Thrall and Leonard Tornheim. 318 pp. John Wiley & Sons, Inc., New York, 1957. $6.75. *Reviewed by T. Teichmann, Lockheed Missile Systems Division.*

Vectors and matrices have become an almost indispensable tool in modern applied mathematics and physics. Parallel with this interest in applications there has been a revival in pure mathematical activity concerned with linear algebra and vector spaces, stimulated at least to some degree by the applications. In the usual way, however, the abstract and applied approaches have gradually diverged so that it may often be perplexing for the user of these methods to gather information from a pure mathematical book on these topics.

The authors of this book have essayed to bridge this gap in the sense of providing a vigorous pure mathematical text combining and interweaving the abstract and concrete approaches. As such it should prove particularly useful to readers interested in applications who also wish to become familiar with the more abstract axiomatic approach. This is not to say that the book makes easy reading, for the unusually large number of unfamiliar symbols and definitions introduced at an early stage makes great demands on the readers concentration. However, the large number of examples and exercises with which the text is interlarded serves to alleviate the more formal aspects of the text.

The first half of the book deals with standard topics of vector spaces, linear transformations, linear equations, determinants, equivalence relations and canonical forms, vector functions, and orthogonal and unitary equivalence. Apart from the usual subject matter, there is an interesting discussion of Hermite matrices in relation to the solution of systems of linear equations. The book then goes on to deeper problems of algebra, including the structure of polynomial rings, the equivalence of matrices over a ring, and the similarity of matrices, the latter chapter including the Cailey-Hamilton theorem. The final chapter deals with linear inequalities, with special reference to game theory and linear programming, and is cast in an easily applicable form. The book concludes with appendices on mathematical induction and relations and mappings, and a brief bibliography. Anyone interested in both pure and applied aspects of matrix theory and prepared to master an initially overcomplicated notation will find the book a valuable addition to his library.

Proceedings of the Symposium on the Physics of Fission (Chalk River, May 1956). AECL No. 329. Edited by G. C. Hanna, J. C. D. Milton, W. T. Sharp, N. M. Stevens, E. A. Taylor. 414 pp. Atomic Energy of Canada Ltd., Chalk River, Ont., Canada, 1956. Paperbound $5.00. *Reviewed by E. Richard Cohen, Atomics International.*

The discovery of fission in 1938 stimulated no small amount of activity in physics. However, it has only been within the last five years that much of this work has been able to emerge from behind the cloak of secrecy. The Moscow Conference in July 1955 and the Geneva Conference in August 1955 on the Peaceful Uses of Atomic Energy represented the first large-scale declassification, and since then a large amount of material has appeared in the open literature.

The symposium reported here was held primarily to educate the personnel at the Chalk River (Ontario) Laboratory and to provide a coherent and unified survey of the state of knowledge of the physics of fission. The papers (twenty in all) are reviews of the field rather than presentations of original research. They are divided into five sections: Background, The Probability of Fission, The Results of Fission, Theoretical Viewpoint, and Concluding Remarks. Each paper is accompanied by an extensive reference list as well as a condensation of the discussion which followed the paper as transcribed from notes taken by the editors.

An unfortunate reminder that all is not yet well with the world is the note in the preface that "Certain classified information presented at the Symposium is issued as a supplementary report."

Solid State Physics. By Adrianus J. Dekker. 540 pp. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1957. $9.00. *Reviewed by Robert T. Beyer, Brown University.*

One of the enduring problems of science is the reduction of research articles, first to review monographs, then to graduate texts, and then, if the field is a sufficiently broad one, to texts that can be used in undergraduate work. Professor Dekker's book carries through this latter stage for the field of solid-state physics.

As soon as the field is selected for writing a book, the problem of the point of view must be resolved. The standard approach in texts dealing with the solid state has been to regard the ideal crystal as the fundamental unit of examination. Only after all problems have been analyzed to their limit in this approximation does the author then append a study of imperfections. However, the pioneering work of Burgers, Frank, Read, Shockley, and others on dislocations and lattice imperfections generally, has suggested a new approach—that the concept of imperfections should be introduced early in a solid-state text, and that applications of such ideas should run concurrently with idealized treatments. This Professor Dekker has done with considerable success.

Much of the material treated in any solid-state text is by this time routine. Outstanding in this book are the considerable treatments of ionic crystals, the excellent summary of the band theory of solids, and the coverage of phenomena in secondary emission, which is much more extensive than is usual in solid-state studies.

The number of literature references is impressive—more than 500 research articles and monographs being cited. While the references are international in scope, it is an interesting commentary on our lack of knowledge of Soviet physics that the reviewer could find only one reference to Soviet work later than 1937—that to Zavoisky's discovery of electron spin resonance in 1945—although the Russian effort in solid-state research must be roughly comparable in magnitude to our own. The use of the literature references would have been facilitated by a name index.

Other than superconductivity (a deliberate omission) no field of solid state appears to have been slighted. Of course, every reviewer can find a few points in which he would have preferred a different handling of the problem. Thus, this reviewer was surprised to find no discussion of Cole-Cole diagrams in the treatment of dielectric phenomena in alternating electric fields, while