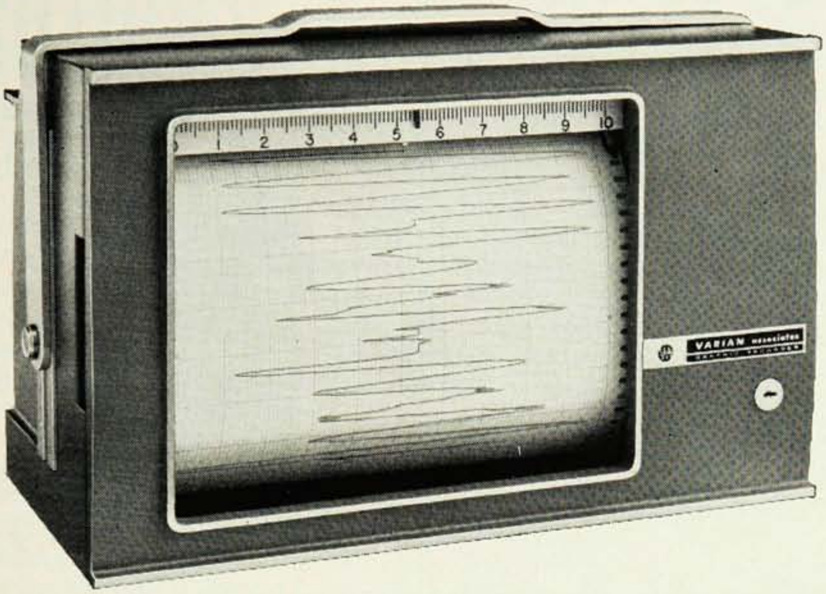
system, but about its own unprovability. And, there is a further striking characteristic of a Gödelian sentence that seems to insure its physical triviality. Gödel showed that in the *metasystem* in which we talk about the undecidable sentence the sentence is indeed unprovable, as it asserts about itself, because it is undecidable; hence, in the metasystem the proposition is correct. So, as regards truth content, rather than status in an axiomatic system, the Gödelian sentence is a true one. There is, then, no irremovable undecidability. This does not at all detract from the significance of the undecidable proposition in changing our concepts of provability and completeness for mathematical systems.

We have had our own incompleteness principle in physics, since the time, a few years before 1930, when quantum mechanics was developed. There is no immediately apparent connection between the quantum uncertainty that was forced on physics by observations of nature and the undecidable sentences of certain logical systems. Still, the parallelism in development is striking, and may give a physicist added reason, in addition to its own intrinsic interest, for studying Gödel's great discovery.

Fast Neutron Physics. Part II: Experiments and Theory. J. B. Marion and J. L. Fowler, eds. Vol. 4 of Monographs and Texts in Physics and Astronomy, edited by R. E. Marshak. 2292 pp. Interscience, New York, 1963. $45.00.
Reviewed by ***H. H. Barschall****, University of Wisconsin.*

The first part of *Fast Neutron Physics*, which is concerned with techniques, appeared over three years ago (*Physics Today*, August 1960). The publication of the long-awaited second part completes this treatise. The two parts together form a monumental work of 2300 pages, containing forty-six chapters written by sixty-two authors. All aspects of the production and of the interactions of fast neutrons are discussed by the foremost experts in the field both from the experimental and theoretical points of view.

In the preface the editors express their regret at the delay which occurred in a number of articles between writing and publication. Some chap-



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In Europe contact Varian A. G., Zug, Switzerland ters in the just-published second part present summaries as of 1957 or 1958 and are unfortunately now out of date. It would have been helpful if for each article the closing date of the literature survey had been given.

Most of the experiments described in the second volume are measurements of partial and total neutron cross sections. Other articles discuss measurements of neutron polarization and of neutron spectra, as well as measurements of gamma rays associated with inelastic scattering of neutrons and with neutrons from charged-particle induced reactions.

Special mention should be made of the chapters on nuclear theory which will be of interest also to physicists not specifically working with fast neutrons. These chapters treat the optical model (W. S. Emmerich), direct reactions (N. Austern), resonances (L. C. Biedenharn), polarization (T. A. Welton), the statistical model (H. Goldstein), fission (J. A. Wheeler), and neutron-proton scattering (J. L. Gammel). Although nuclear theory is changing more slowly than experimental methods, even some of these theoretical contributions suffer from the delay in publication.

Everyone who either does research in nuclear physics or is concerned with nuclear reactors would undoubtedly like to have both volumes of *Fast Neutron Physics* on his bookshelf, but unfortunately the price of $74.00 will keep many from acquiring this useful reference work.

Solid State Theory. By Mendel Sachs. 350 pp. McGraw-Hill, New York, 1963. $10.75. *Reviewed by **Peter Grosewald**, The Pennsylvania State University.*

Dr. Sachs has deliberately limited his book both as to scope and to audience, and has written an excellent book within that framework.

Important aspects of the book from a pedagogical point of view are the sharp and repeatedly emphasized distinction between reality and ideality, extensive use of footnotes rather than a general bibliography, the inclusion of problems (one or two per chapter), purely for illustrative purposes rather than as part of the text; chapter summaries, and, most important of all, continuity of subject matter. The level of the over-all text is not uniform but is counterbalanced by the logical sequence of presentation.

In terms of actual content the text attempts to present the most modern aspects of solid-state theory, i.e., the collective description of the cohesive energy of solids (Bohm-Pines) as well as the Wigner-Seitz theory, both treated extensively in Chapter 10.

Brillouin zones and the reciprocal lattice aren't introduced until a thorough background of one-electron scattering theory in simplified systems is assured. The book is primarily concerned with two basic features of solids, the symmetry properties and the electronic band structure which arises because of the former. The approach to these properties is controlled by the nature of the main intended audience, those with an interest in theoretical physics, and so group theory is used to derive the symmetry properties of crystals and the two are used in turn to develop crystalline field theory.

On the debit side, and unfortunately, within the designated framework, there are several points to consider before chosing *Solid State Theory* as a text. The limitation to only two features (which do cover a wide range) of the physical properties and the relatively small size of the book hinder using it as a replacement for one of the older "standard" texts. There is only one chapter essentially devoted to relating theoretical predictions and experimental observations, but in compensation, allusions to experimental confirmation are frequent in the footnotes.

In summary, the book is to be wholeheartedly recommended for the library of the general theoretician, solid-state physicist, and those in allied fields, but with reservations as a text for a general introductory solid-state course.

An Introduction to Waves, Rays and Radiation in Plasma Media. By J. J. Brandstatter. 690 pp. McGraw-Hill Book Co., Inc., New York, 1963. $15.00. *Reviewed by **Sanborn C. Brown**, Massachusetts Institute of Technology.*

Plasmas at the present time are relatively poorly understood, and much that is known about them comes more from phenomenological and intuitive approaches than from detailed mathematical analyses of conditions which may or may not have physical reality. For this reason the preoccupation with mathematical exactness generally prevents the author of this book from coming to grips with the physical plasma itself. The selected topics chosen by the author are developed very well but in great detail. In fact, the author often dwells so long on the minutiae and fine points of the mathematical analysis that the book often becomes dry and tedious.

In the introduction the author states that he "aims the text at the senior-graduate university student." This is a very commendable aim but I think that this is just what the text does not do. Nowhere in the book are there any down-to-earth examples or order-of-magnitude calculations to see what factors are physically real and what factors, although mathematically interesting do not add to our understanding of the plasma mechanisms. It is, in fact, a reference book for the specialist on the several selected topics of interest to the author. It certainly could not be recommended as the basis of a graduate course.

As a comprehensive text of waves in plasma, the book leaves out too many important mechanisms to be a valid and balanced graduate-school text. It mentions only briefly such things as spatial dispersion, says nothing about instabilities and growing waves, and shuns all but collisional damping. The reason for leaving some of the important mechanisms out is a great puzzle to this reviewer. For example, the author states that Landau damping is not treated because it requires complex variable theory. On the other hand, all through the book, tensor calculus is expected to be a basic working tool of the reader, and Fourier transforms are used whenever convenient. Yet mathematical complexity cannot be the reason for the omission of such things as cyclotron damping, since the degree of mathematical sophistication for a treatment of this subject is certainly less than that of many of the theoretical tools used throughout the book.

There is no reference whatever to experimental observations or any treatment of real plasmas. The book is the outgrowth of lecture notes on the theory and application of ray propaga-