is detailed enough to provide a good introduction to the field.

The theory of the properties of imperfect gases has not advanced greatly since the appearance of the book by Hirschfelder, Curtiss and Bird. The main advance has been in computation made possible by large digital computers. Much of this work, for example, the calculations of fourth and fifth virial coefficients, has not enlarged our knowledge of intermolecular forces, and so the authors cover it only briefly.

The authors explore the relation between the properties of solids and intermolecular forces. Here the advances in the past 25 years have been computational rather than theoretical.

They conclude their book with a survey of the present status of knowledge of the intermolecular forces, not only of simple molecules such as the inert gases, but also of complex molecules such as water, where there is much yet to be done.

Maitland, Rigby, Smith, and Wakeham are to be congratulated for preparing this welcome volume. It should be in any good institutional library. Although the price is steep, I also recommend this volume for the personal libraries of all those interested in intermolecular forces and their relation to the properties of gases, liquids and solids.

DOUGLAS HENDERSON
IBM Research Laboratory
San Jose

Fusion Research: Vol. 1, Principles; Vol. 2, Experiments; Vol. 3, Technology

T. Dolan
855 pp. Pergamon, New York, 1982. $120.00 cloth, $75.00 paper

Research on thermonuclear fusion has entered a new era with the first operation of the Tokamak Fusion Test Reactor (TFTR). This machine, as well as several others with similar operating parameters, is expected to demonstrate the scientific feasibility of fusion in the next few years and to set the stage for work on fusion engineering facilities and reactor prototypes. The knowledge required for the design, construction and operation of these devices will come from many diverse fields. In *Fusion Research* Thomas Dolan describes the state of the art in the many branches of fusion physics and engineering in a form useful to both students and professionals.

The first volume, *Principles*, introduces the physics of fusion plasmas. Dolan gives few lengthy derivations, emphasizing instead the presentation of results. Sections on Coulomb collisions and atomic radiation lead to development of a point reactor model which is used to discuss power balances for a number of reactor types. Next come several chapters on plasma fundamentals, which suffer slightly from the condensation of material and a confusing arrangement of some topics. For example, Dolan derives macroscopic fluid equations before he presents Debye shielding, quasineutrality or single-particle orbits. Fortunately he provides numerous example problems (in all chapters) to help clarify material for the reader. The remaining chapters, on plasma confinement, heating, and diagnostics, are comprehensive and clearly written.

The second volume, *Experiments*, discusses a large number of magnetic and inertial-confinement concepts. It includes chapters on ICF targets, drivers and chambers. Some theory of the equilibrium, stability, and transport properties of these devices appears, along with experimental parameters achieved in the latest generation of machines. Because some sections of this volume depend on material presented in *Principles*, these two volumes should be used together.

The final volume, *Technology*, covers the engineering aspects of fusion research, with sections on vacuum systems, magnets, plasma purity and fueling, materials problems, blankets and shielding, environmental effects and fusion–fission hybrids. Dolan discusses theory, design requirements, and operation of fusion subsystems. Because the material here does not depend heavily on earlier sections and Dolan provides most of the essential background material, this volume can be understood independently of the others. This volume gives a clear picture of the current state of fusion technology, where problems exist, and the research that is being carried out to solve them.

Each chapter closes with an extensive list of references broken down by subject. In addition, there are problem sets suitable in difficulty for senior undergraduates in the *Principles* and *Technology* volumes (Chapters 1–10 and 19–28).

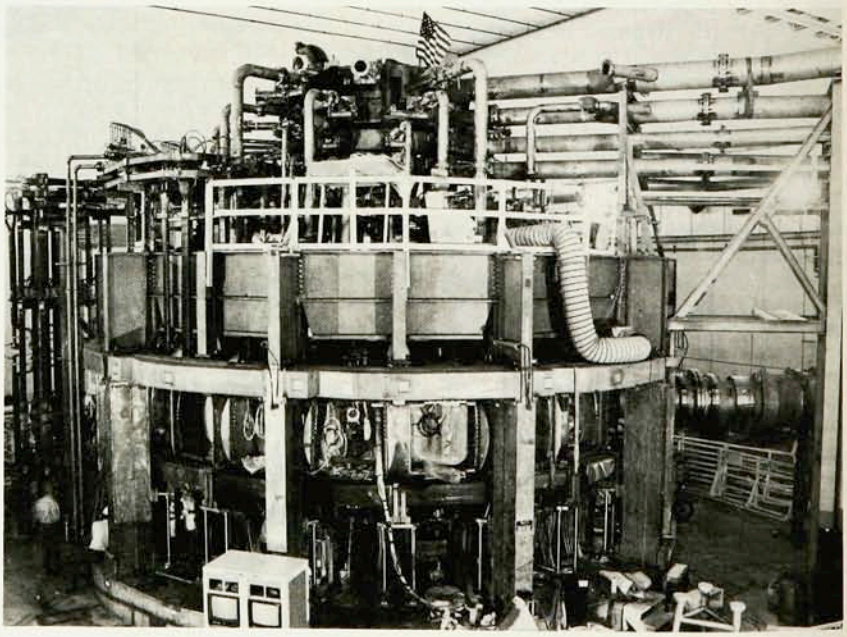
Fusion Research is comprehensive, well-researched and timely. It would be a valuable addition to the library of anyone interested in fusion.

BRADLEY J. MICKLICH
Princeton University

Collected Scientific Wokrs of A. D. Sakharov

D. V. Chudnovsky, G. V. Chudnovsky, D. ter Haar, eds.
303 pp. Dekker, New York, 1982. $27.50

This volume brings together for us in the West writings that display the full power and range of Andrei Sakharov's brilliant research achievements in theoretical physics. Sakharov is widely recognized, particularly in the West, as the father of the Soviet hydrogen bomb and as a moral leader in the search for peace, progress, and basic freedoms. Until recently we have known less about Andrei Sakharov the scientist. The editors of this volume, David and Gregory Chudnovsky and Dirk ter Haar, themselves distinguished math-



The Tokamak Fusion Test Reactor at the Princeton Plasma Physics Laboratory, which achieved its first plasma in December 1982 (see PHYSICS TODAY, March, page 17). *Fusion Research*, reviewed here, discusses this and other fusion devices.

NORTH-HOLLAND ANNOUNCES

NORTH-HOLLAND PUBLISHING CO., P.O. Box 211, 1000 AE Amsterdam - The Netherlands
ELSEVIER SCIENCE PUBLISHING CO., Inc., 52 Vanderbilt Ave., New York, N.Y. 10017

NEW BOOKS - NEW BOOKS - NEW BOOKS - NEW BOOKS

Dislocations in Solids

Volume 6

Applications and Recent Advances

edited by F. R. N. NABARRO

1983 viii + 552 pages
Price: US $104.00/Dfl. 245.00
Subscription Price:
US $ 88.50/Dfl. 208.25
ISBN 0-444-86490-3

The first five volumes of this series formed a basic statement of the knowledge available on dislocations in solids. The present volume is concerned with some of the applications of this knowlegde to practical problems of metallurgy and materials science, and with some recent advances in research on dislocations.

The main features are applications of dislocation theory to practical technological problems, e.g. friction and wear, metal fatigue and the growth of dislocation-free semiconductor layers, and results of new experimental techniques for the study of dislocations, including the behaviour of dislocations at very low temperatures, the scattering of phonons by dislocations and the influence of dislocations on the annihilation of positrons.

CONTENTS: The application of dislocation concepts in friction and wear *(J. P. Hirth and D. A. Rigney).* The application of dislocation concepts in fatigue *(C. Laird).* The growth of dislocation-free layers *(C. A. B. Ball and J. H. van der Merwe).* Dislocations and strength of metals at very low temperatures *(V. I. Startsev).* The scattering of phonons by dislocations *(A. C. Anderson).* Dislocation studies with positrons *(J. G. Byrne).* Slip-line formation and collective dislocation motion *(H. Neuhäuser).* Dislocations in solids investigated by means of nuclear magnetic resonance *(J. Th. M. De Hosson, O. Kanert and A. W. Sleeswyk).*

Enrico Fermi International Summer School of Physics

Volume 83

Positron Solid State Physics

edited by W. BRANDT† *and* A. DUPASQUIER

1983 about 716 pages
Price: US $142.50/Dfl. 335.00
Subscription Price:
US $121.25/Dfl. 284.75
ISBN 0-444-86521-7

The curriculum of this Enrico Fermi Summer School was set up with the following objectives:

- to train scientists in the methodoiogies of Positron Solid State Physics, a field which draws from many disciplines in contemporary physics;
- to assess advances in experimental techniques;
- to apply the "positron method" to all types of condensed matter.

CONTENTS: Preface. Statistical Dynamics of Positrons in Solids *(W. Brandt).* Positrons in Metals *(J. P. Carbotte).* Momentum Density and Fermi Surface Measurements in Metals by Positron Annihilation *(S. Berko).* Momentum Density in Metals and Alloys: Theory *(P. E. Mijnarends).* Experimental Methods of Annihilation Time and Energy Spectrometry *(I. K. MacKenzie).* Defects in Thermal Equilibrium: Positron Annihilation and other Methods *(K. Maier).* Studies on Non-Equilibrium Defects in Metals *(K. Petersen).* Defect and Surface Studies with Positrons *(R. M. Niemonen).* The Scattering of Positrons at Surfaces *(J. B. Pendry).* Experimentation with Low Energy Positron Beams *(A. P. Mills, Jr.).* Positronium-like Systems in Solids *(A. Dupasquier).* Implantation of Fast Positrons in Solids *(R. Paulin).* Positrons Annihilation using High Density Multiwire Chambers *(A. A. Manuel).* Positron Prevacancy Effects in Pure Annealed Metals *(L. C. Smedskiaer).* Slow Positrons in the Study of Surface and Near-Surface Defects *(K. G. Lynn).* Positronium in Molecular Solids *(M. Eldrup).* Positron Lifetime Techniques as a Tool in Defect Spectroscopy *(A. Vehanen and K. Rytsölä).* Positrons in Amorphous Alloys *(P. Moser and C. Corbel).*

Available again!

Mathematical Methods in Physics

2nd revised ed., 1st repr.

by J. S. R. CHISHOLM *and* R. M. MORRIS

1983 xviii + 719 pages
Price: US $51.00/Dfl. 120.00
ISBN 0-7204-1152-1

This book is primarily designed as a pure mathematics text-book which should serve students of physics, chemistry and engineering. While the book is probably best used in conjunction with lecture courses, it is designed to be used for private study by students with a knowledge of algebra and of elementary trigonometry and co-ordinate geometry. The text is therefore illustrated with numerous examples and several sets of excercises have been included in each chapter.

The main aims of the work are to teach mathematical techniques and to give a clear account of useful concepts in mathematics and mathematical physics.

CONTENTS: **Chapters 1.** Functions, Limits, Continuity, Differentiation. **2.** Integration, Simple Methods. **3.** The Convergence of Infinite Series. **4.** The Logarithmic and Exponential Functions. **5.** Integration, Further Results. **6.** Further Theorems concerning Functions of One Variable, Expansion in Series. **7.** Complex Numbers. **8.** Functions of More Than One Variable. **9.** Vector Algebra. **10.** Applications of Vector Algebra to Analytical Geometry of Straight Lines and Planes. **11.** Vector Functions, Differential Geometry of Curves, Line Integrals. **12.** Matrices, Determinants and Linear Dependence. **13.** Linear Equations Eigenvectors and Eigenvalues. **14.** Curvilinear Co-ordinates and Multiple Integrals. **15.** Vector Analysis. **16.** Ordinary Differential Equations. The Laplace Transform. **17.** Functions of a Complex Variable. **18.** The Dirac δ -Function; Fourier Series and Integrals. **19.** Factorial, Legendre and Bessel Functions. **20.** Statistics and Probability.

JOURNAL INFORMATION:

Computer Physics Reports

Coordinating Editor: G. DIERCKSEN, *Garching, F.R.G.*

Early in 1983 the new journal COMPUTER PHYSICS REPORTS will be published. It will consist of unique issues, each containing a single review devoted to a separate area of computational physics. Special emphasis will be put on a straightforward presentation of the subject with respect to automatic computation. In particular, basic principles of implementation of the different methods, any special computer resources needed for it, and the limitations of it in relation to the available hardware, will be discussed.

The reviews, excluding the abstract, will be divided into three major parts. The first part will be a general review section introducing the reader to the basic principles and concepts of the subject. The second part will provide the methods and algorithms used and the way these were implemented in the machine. The third part will provide a self-contained list of mathematical formulas, which will enable the reader to follow a complete route in cases where he/she wants to use the methods him/herself.

Subscription details:

1983: Volume 1 in 8 issues
Price: US $153.00/Dfl. 360.00*

**(Dutch guilder price is definitive)*
For more details and/or a free inspection copy, contact the publisher.

US $ prices are valid only in the USA and Canada. In all other countries the Dutch Guilder price is definitive. All prices are subject to change without prior notice.

P701 NH

Circle number 23 on Reader Service Card

ematicians and physicists, have collected in a single volume most of Sakharov's scientific papers from 1947 to 1980, most of them already published in English, together with his brief and illuminating autobiography and his Nobel Peace Prize lecture of 1975.

The scientific papers are organized into three parts: plasma physics, cosmology, and field theory and elementary particles. Each part starts with comments by Sakharov on his research in these fields and concludes with useful and interesting commentary on his work by specialists in these fields.

Sakharov's research contributions to plasma physics, particularly, to controlled thermonuclear reactions, rank with his most important published achievements. A 1950 paper by Sakharov and I. E. Tamm, addressed mainly to the problem of producing net power from a hot deuterium plasma confined in a magnetic bottle, describes a particular type of toroidal bottle that later rose to fame under the name tokamak. Also in 1950 Sakharov first proposed and analyzed the novel idea that extremely high magnetic fields (up to 20 megagauss) could be generated by using an explosive charge to compress a metal tube containing axial magnetic flux. The theoretical and experimental development of this idea has continued to the present date. Another idea of Sakharov's was the potential of mu-meson catalysis of fusion reactions in cold deuterium.

The range of Sakharov's scientific contributions in the field of cosmology is represented in this volume by eight papers, including work completed following his exile to Gorki in 1980. In his most prescient and fundamental contribution, Sakharov in 1966 put forward the first good reasons to believe that the baryon number may not be an absolutely conserved quantity. His bold suggestion of proton decay was stimulated by his quest to understand the baryon asymmetry of the universe, that is, the predominance of matter and the absence of antimatter.

Sakharov also introduced the suggestion that departures from equilibrium occurring during early stages in the expansion of a "hot" universe created the observed baryon assymetry of the universe (that is, the asymmetry given by the fact that there are 10^9 photons for every baryon) starting from an initial charge-symmetric state.

The third part of the volume contains eleven research papers that chronicle Sakharov's efforts since 1967 to develop a new approach to a theory of gravitation and his studies of quantum field theory. These range from topological analyses of the structure of the theory to phenomenological ones of quark models to derive mass formulae for mesons and baryons.

Sakharov's original approach to a new theory of gravitation is described by Stephen Adler: "The Einstein action is not a fundamental action at all, but rather is an induced effect [due to, in Sakharov's words], 'the metrical elasticity of space' resulting from quantum fluctuations of the matter fields." Adler and others in the West have recently been striving to build, from such ideas, a renormalizable field theory of gravitational phenomena in which the gravitational and unification scales are related to one another.

To summarize, the book is an impressive testament to the scientific creativity of one of the major theoretical physicists of our time.

SIDNEY DRELL
Stanford Linear Accelerator Center

Radiological Imaging: The Theory of Image Formation, Detection, and Processing

H. H. Barrett, W. Swindell
Academic, New York, 1981. 2 Vols. $55.00

Diagnostic radiological physics has grown in the last decade from a field based on photographic film to one including sophisticated images generated by analog and digital computers. Unfortunately, the literature describing the new technologies has been sparse and hidden in engineering libraries. Several new books attempt to fill this gap. Perhaps the best of these is the pair of volumes reviewed here.

In *Radiological Imaging*, Harrison Barrett and William Swindell attempt to fill two needs: to "prepare the student to do research in radiological imaging" and "to teach general image science within a radiographic context." Any attempt at fulfilling both these purposes is fraught with dangers. This text, however, is an excellent attempt. Used as a companion to the more standard medical and radiological physics texts, which are woefully inadequate on modern imaging theory, it can bridge the gap between physics graduate training programs and engineering programs and be a major contribution to both.

The first volume introduces the clinical setting for imaging problems and then, in individual chapters, analyzes linear-system theory, random processes, their applications to radiographic imaging and finally to detectors. What is lacking in basic dosimetry and mathematical function theory is discussed in four excellent appendices that should be understood before beginning study of the text.

Weaknesses in the text include the lack of problems for practice, brief statements about the "comparable quality" of analog and digital computed-tomography images (which is very