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The Search for the Missing Science of Consciousness

ROGER PENROSE

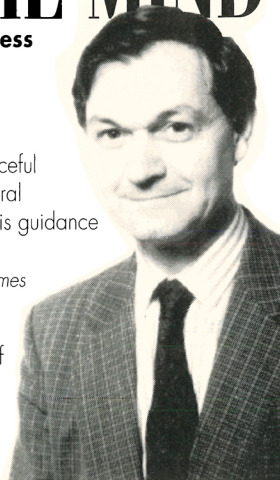
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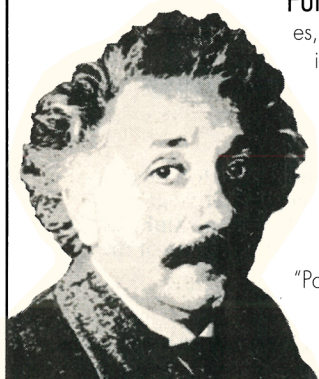
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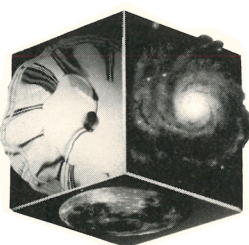
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by Takeo Fujiwara and "Electron Structure of Solids" by Christian Mailhiet—do an excellent and authoritative job of summarizing the state of the art. However, there is no treatment of substitutionally disordered metallic alloys or of single impurities in metals. Perhaps such omissions will be remedied in subsequent volumes. In any case, this encyclopedia should be in the library of any institution where physics is studied.

STEVEN J. ROTHMAN

ROY BENEDEK

SIMON R. PHILLPOT

Journal of Applied Physics

Argonne, Illinois

Modern Physics from α to Z^0

J. W. Rohlfs

Wiley, New York, 1994.

646 pp. \$70.95 hc

ISBN 0-471-57270-5

In the preface to *Modern Physics from α to Z^0* , James William Rohlfs states that "more is better" because extra details are necessary to challenge the curiosity of the "hungry student." He goes on to argue that this approach provides a convenient introduction to advanced material and allows the professor some flexibility in choosing the pace and content of the course. Rohlfs is faithful to his motto throughout this book and thereby has given the physics community a new type of modern physics text.

The book is designed to be used in a one-semester course in modern physics for students who have completed one year of calculus-based mechanics and electrodynamics. All of the traditional topics of such a course are treated in detail, and this alone could easily produce a rigorous course in modern physics. But there is much more. Interwoven with the traditional topics, and in additional chapters at the end, are many topics from the advances of physics in the past half century. Quarks, leptons and the four forces of nature are introduced early, discussed at various times throughout the text and covered in detail in two chapters near the end. The quantum Hall effect, high- T_c superconductivity, scanning tunneling microscopy, quantum chromodynamics and the early universe are all discussed at the appropriate times. The chief strength of the book lies in its treating the recent advances along with the traditional topics in an organized and coherent way. An instructor who desires to teach a challenging course that includes some of

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the most exciting developments of the past few decades will find more than enough material in Rohlfs's book.

There are a few pedagogical weaknesses that limit the utility of this book as a text in a modern physics course. Its coverage is massive for a one-semester course, and its style is quite terse. Often the most important aspect of a new concept is given first, followed by a good deal of discussion and the requisite development. A student who requires ample background, a logical development of new concepts and carefully selected examples will be frustrated. There are more than the typical number of examples scattered throughout the text, but most call for the mere plugging of numbers into formulae. The examples suffer as well from a layout that does not clearly mark the end of an example; readers may often think the discussion is still about the example when in fact it is a continuation of the text preceding the example.

The level and coverage are similar to Robert Eisberg and Robert Resnick's *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles* (Wiley, 1985), and it is more advanced than *Modern Physics* by Raymond A. Serway, Clement J. Moses and Curt A. Moyer (Saunders College, 1989). The inclusion of so many contemporary topics and the up-to-date nature of the discussion, however, set it apart from other modern physics texts.

PETER J. COLLINGS

*Swarthmore College
Swarthmore, Pennsylvania*

Glass Science

Robert H. Doremus

Wiley, New York, 1994.

Second edition. 339 pp.

\$74.95 hc ISBN 0-471-89174-6

This book is the first revision and expansion of a text published more than 20 years ago. The original volume has served as a valuable reference and course textbook on glass science for both students and researchers in the field. In this new edition, Robert Doremus provides a broad, updated overview of the fundamental structure and microstructure of glasses, as well as treatments of their mechanical, optical, chemical and electrical properties. The focus, however, is the basic understanding of glasses rather than a comprehensive compilation or tabulation of properties. Some of the topics covered are glass formation and processing, phase separation, viscous behavior, surface properties, gaseous diffusion and interactions, chemical durability, and

ionic exchange and transport. The author has also introduced substantial new material on subjects or glasses that have emerged or grown in significance in recent years, such as fast-ion conductors, heavy-metal fluoride glasses and glass corrosion and dissolution in water.

Doremus's book serves as both an introduction and a reference to the current field of glass science. It should prove useful as a textbook for advanced undergraduate and first-year graduate students, as well as an updated, broadly based reference for researchers and technologists working in the field. While a large number of books have appeared in recent years on such specialized glass topics as sol-gels, fluorides, optical fibers, bioglasses and glass ceramics, there are very few books like this one, which provides a comprehensive overview of glass in a single volume. One disappointment, however, at least from my perspective, is the limited discussion and updating of the section on optical properties, although the author does provide an excellent list of references in this area. Nonetheless, if one is to have only a single reference on glassy materials on the shelf, this book is certainly a good candidate.

The author has had a distinguished career in both industry and academia, first with the General Electric Research Laboratory in Schenectady, New York and, since 1971, as a faculty member in the materials engineering department at Rensselaer Polytechnic Institute, where he is the New York Professor of Glass and Ceramics. He thus merges the insights and expertise of an academic researcher with the practical experience of an industrial scientist as he selects and presents his material, never losing sight of the need for a definitive university textbook on glass science.

GEORGE H. SIGEL JR

*Rutgers University
New Brunswick, New Jersey*

Stochastic Dynamical Systems

Joseph Honerkamp

VCH, New York, 1994.

535 pp. \$100.00 hc

ISBN 1-56081-563-9

Stochastic Dynamical Systems is an excellent translation (by Kata Lindenberg) and expansion of the German edition published in 1989. As a neophyte in stochastic processes, I approached it with the fervent hope that it would expand my knowledge of deterministic dynamical systems to in-

clude the stochastic variety. However, despite its title, this book is not really about stochastic dynamical systems, which would pertain to the qualitative analysis of dynamical models. It is instead an introduction to stochastic processes and stochastic differential equations. Stochastic dynamical systems are the focus of recent research publications by Ludwig Arnold and his collaborators (for example, Arnold and Hans Crauel's "Random Dynamical Systems", in *Lecture Notes in Mathematics 1486*, Springer-Verlag, 1991), but I was hoping for a textbook treatment.

On the other hand, the need for a text like Honerkamp's is clear. As the author states in his preface, "Probability theory is not afforded the appropriate attention" in classical theoretical physics courses, even though probabilistic techniques—ranging from data analysis to the modeling of complex systems—are essential tools for physicists. He attempts in this book to remedy this situation. *Stochastic Dynamical Systems* is written as a text for a graduate course in probability and stochastic processes, and its level makes it accessible to first-year graduate students. Its scope is vast, which, I believe, is both its major advantage and its major shortcoming. I can best illustrate this by trying to delineate the range of topics covered.

The initial chapters of the book cover basic notions of probability theory—from the definition of a random variable to such notions as cumulants and factor analysis. As is appropriate for a physics text, there is mention, but no extensive use, of such concepts as Borel sets, nor is the notation onerously mathematical.

Subsequent chapters cover the analysis of linear stochastic differential equations, Brownian motion, Fokker-Planck equations, path integral methods and even graph theoretic techniques for perturbation solution of nonlinear stochastic differential equations. There is a succinct, practical guide to the different calculi (Stratonovich and Ito) for the treatment of systems with white noise ("In physical equations one tends to choose the Stratonovich interpretation [because] white noise is always an idealization"). The final sections cover data analysis, with an extensive treatment of time series by linear filtering and autoregressive moving average methods. A major omission is a discussion of recent nonlinear methods for the fitting of time series. This topic is extensively covered in volume 58 of *Physica D* and in the review by Henry Abarbanel *et al.* in