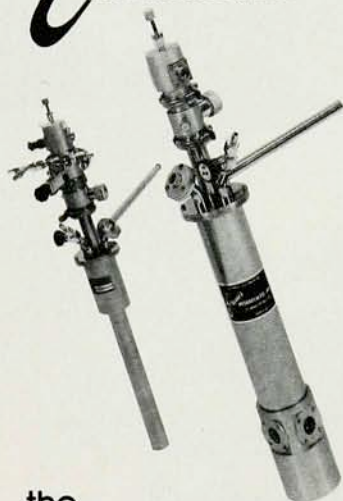


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novice, made by *Computer Simulation of Liquids* is its clear and exhaustive description of the tricks of the trade. These include details of common pitfalls and recipes for avoiding them and for speeding up programs. Also included in an appendix are many programs and subroutines on microfiche, ranging from common Monte Carlo and molecular dynamics algorithms to routines for avoiding the "time-consuming" square-root operation, calculating fast Fourier transforms and performing Ewald sums.

The latter part of the book focuses briefly on some nonequilibrium aspects of molecular dynamics simulations, on Brownian dynamics and, most briefly, on quantum simulations. Overall, the book makes available sufficient information for a beginner to get started doing simulations. The book's principal weak point (probably deliberately) is the lack of a comprehensive description of the physics of liquids. However, a long list of pre-1987 references is included at the end of the book.

The book, though not suitable as a text, will be a valuable reference for those using the computer to perform simulations of liquids (or, indeed, of other systems) and especially for those entering this fast-growing field.

JAYANTH R. BANAVAR

Pennsylvania State University

Relaxation Phenomena in Condensed Matter Physics

Sushanta Dattagupta

Academic, San Diego,
Calif., 1987. 309 pp.

\$39.50 hc ISBN 0-12-203610-7

Sushanta Dattagupta's admirable *Relaxation Phenomena in Condensed Matter Physics* is similar in many respects to Dieter Forster's monograph *Hydrodynamic Fluctuations, Broken Symmetry, and Correlation Functions* (Benjamin-Cummings, Menlo Park, Calif., 1975). The main distinction between the two is that Dattagupta's book focuses on problems of concern to solid-state physicists while Forster's is mainly concerned with liquid-state problems. In addition, Forster's book is probably more profound because it stresses the hydrodynamical consequences of broken symmetries.

Relaxation Phenomena is broken up into two parts. In part A Dattagupta reviews how linear-response theory and correlation functions can be used to analyze various spectroscopy experiments. The nicest feature of his approach is that with a single,

unified formalism Dattagupta analyzes an enormous number of experiments. Among many other topics, he considers magnetic, dielectric and anelastic relaxation; electron spin and nuclear magnetic resonances; and neutron and Raman scattering.

In part B of the book Dattagupta discusses the stochastic modeling correlation functions. After briefly discussing some of the basic ideas in the theory of stochastic processes, Dattagupta introduces random-walk methods, both discrete and continuous in time. The treatment here is very much in the style of the late Elliot Montroll. Again the author applies the ideas under consideration to a very large number of physical phenomena and to their phenomenological modeling. Next he uses Fokker-Planck and first-passage-time methods to treat activated barrier-crossing problems. The treatment here is competent, though not novel. Once again many physical examples are considered and discussed in detail.

The book concludes with chapters on relaxation in cooperative systems and relaxation in disordered systems. I was disappointed that more of the book was not devoted to these topics of current research interest. The first of these two chapters deals exclusively with Glauber dynamics in a regular Ising model. The focus is on approximate mean-field solutions. The bulk of the last chapter is on the dynamics in a disordered Ising chain and how it compares to the dynamics in a regular Ising model. Only a brief mention is made of the very general topic of relaxation in glassy systems.

In conclusion, I am happy to have this book on my shelf. Its main strength is the large number of interesting experimental situations and probes treated. For my taste its chief weakness is the overemphasis of stochastic modeling of physical situations. In addition, the book could use more graphs of real experimental data and a more lengthy discussion of cooperative effects in disordered systems.

THEODORE KIRKPATRICK
University of Maryland

Galactic and Extragalactic Radio Astronomy

Edited by

Gerrit L. Verschuur and
Kenneth I. Kellermann

Springer-Verlag, New York,
1988. Second edition. 694 pp.
\$79.95 hc ISBN 0-387-96575-0

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Some Important Textbooks

FRactal Growth Phenomena

by T Vicsek

This book summarizes the basic concepts born in the studies of fractal growth and also present some of the most important new results for more specialized readers. Accordingly, it may serve as a textbook on the geometrical aspects of fractal growth and treat this area in sufficient depth to make it useful as a reference book.

368 pp Jan 1989 50-442-1(US\$67)H/C 50-830-3(US\$32)S/C

Braid Group, Knot Theory and Statistical Mechanics

edited by M L Ge (Nankai) & C N Yang (Stonybrook)

There has been recent exciting new developments in the theory of knots, and this volume more than meets the great interest in this subject today. Comprising reviews by those who have been making major contributions in this area of research, this review volume is a comprehensive summary of an exciting new subject.

Contributors: T Kohno; L H Kauffman, M Wadati & Y Akutsu; L D Faddeev; M Jimbo; V F R Jones & V G Turaev.

350 pp (approx.) Apr 1989 50-828-1(US\$58)H/C
50-833-8**(US\$28)S/C

Physical Properties of High Temperature Superconductors (I)

edited by D M Ginsberg (Illinois, Urbana-Champaign)

This book is perhaps the best in the field describing the fundamental properties of high temperature superconductors in an organized and comprehensive manner. The authors of the reviews are well known for their creative and powerful research on the new superconductors. The reader will be helped to understand the theoretical and practical implications of high- T_c superconductivity. Therefore it is a useful book for research workers and graduate students.

524 pp Feb 1989 50-683-1(US\$84)H/C 50-894-X**(US\$48)S/C

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Reviews from Physics Today

Statistical Mechanics

by Shang-Keng Ma

This is a unique and exciting graduate and advanced undergraduate text written by a highly respected physicist who had made significant contributions to the subject. Particular emphasis is given to the fundamental assumption of statistical mechanics $S = \ln \Gamma$ and its logical foundation. Computational rules are derived without appeal to abstract ensemble theory.

"This book could potentially take a place alongside the classic monograph of Landau and Lifshitz as a valuable reference tool. Ma's book will almost certainly provide a challenge to the intellects of a growing number of active researchers. The instructor who adopts the book as a primary text will welcome the generous number of problems that appear at the end of each of the 30 chapters."

H Eugene Stanley
Physics Today (USA), 1988

576 pp May 1985 966-06-9(US\$85)H/C 966-07-7(US\$38)S/C

Supercollider Physics and Related Topics

Calorimetry for the Superconducting Supercollider

Alabama, USA 13-17 March 1989

edited by R Donaldson & M Gilchriese (LBL)

This proceedings will contain detailed descriptions and discussions of all aspects of calorimetric systems for experiments at the Superconducting Supercollider. It will include requirements for SSC physics, calorimeter simulations and predictions of performance, requirements for electronics and triggering, and discussions of the nature and feasibility of liquid argon, warm liquid, scintillating, silicon and gas calorimetry for large experiments at the SSC.

700 pp (approx.) Nov 1989 50-918-0(US\$89)H/C

Particles, Strings, and Supernovae — (2 Vols.)

Proceedings of the Theoretical Advanced Study Institute in Elementary Particle Physics

Rhode Island, USA 6 June-2 July 1988

edited by A Jevicki & C-I Tan (Brown, USA)

This proceedings is a follow-up for the TASI series held annually to discuss the current theoretical and experimental status in elementary particle physics. Since TASI is designed primarily for advanced graduate students, lectures tend to be pedagogical, in the same mood as the equally successful Erice schools. Brown TASI-88 covered four inter-related areas: Standard Particle Physics, Non-perturbative Aspects of Quantum Field Theories, Strings and Superstrings, Cosmology and Neutrino-Astrophysics.

1000 pp (approx.) May 1989 50-792-7(US\$86)H/C
50-793-5(US\$48)S/C

Proceedings of the Storrs Meeting

1988 Meeting of the Division of Particles and Fields of the American Physical Society

Storrs, Connecticut 15-18 August 1988

edited by K Haller, D G Caldi, M M Islam, R L Mallett,
P D Mannheim & M S Swanson (Connecticut)

This is the only meeting of the entire U.S. particle physics community, and is the successor to the meetings held at Santa Fe, Eugene, Oregon and at Salt Lake City. The meeting is a forum for the presentation of important scientific results, plans for research facilities, and status reports of major fields of investigation.

952 pp Apr 1989 50-777-3(US\$86)H/C 50-797-8**(US\$38)S/C

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World Scientific Lecture Notes in Physics — Vol. 9

Spin Glass Theory and Beyond

An Introduction to the Replica Method and Its Applications
by M Mezard (Paris), G Parisi & M Virasoro (Roma)

This book contains a detailed and self-contained presentation of the replica theory of infinite range spin glasses. The authors also explain recent theoretical developments, paying particular attention to new applications in the study of optimization theory and neural networks. "The authors give a masterly account of the work on the model in the first 85 pages. Such a summary cannot be found elsewhere, and much of our current understanding of the problem is due to the authors of this book and their collaborators. This is an important book, which every physics library should have. It is also good reading of anyone who wants to know about these aspects of the spin glass problem, and why 'replica symmetry breaking' and 'ultrametricity' may be important."

David J Thouless
Physics Today, 1988

476 pp Nov 1987 50-115-5(US\$86)H/C 50-116-3 (US\$48)S/C

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has been spearheaded by radio-astronomy. Radio observations were the first to give us a view of the universe at wavelengths outside the narrow band of visible radiation and, as is well known, led to the discoveries of radio galaxies, quasars, pulsars and the microwave cosmic background radiation. Although many important discoveries have been made more recently by observations in the far infrared, ultraviolet, x-ray and gamma-ray bands, radioastronomy shares with optical and near-infrared astronomy the great advantage that it is possible to observe from the ground. The most powerful radiotelescope now in service is the Very Large Array of 27 antennas in New Mexico, operated by the National Radio Astronomy Observatory. This telescope, which has produced many of the discoveries described in *Galactic and Extragalactic Radio Astronomy*, makes images of the sky with better resolution than is routinely obtainable with the best ground-based optical telescopes. The Very Long Baseline Array, which will make images with a resolution of 0.0001 arcsecond, is now nearing completion and should continue the revolution in our understanding of the universe.

The first edition of Gerrit Verschuur and Kenneth Kellermann's book was published in 1974, before the construction of the VLA. It was welcomed at that time as a fine survey of the full range of astronomical phenomenology revealed through the radio wave band. The new edition, as fine as its predecessor, is over 70% longer, reflecting the great growth in the subject following the completion of the VLA. It is natural that there should be an emphasis on the VLA results, as both the editors and many of the contributors are associated with the National Radio Astronomy Observatory, but the book also includes many results from the new millimeter and submillimeter telescopes that have been constructed in the last few years [see *PHYSICS TODAY*, August 1987, page 65], as well as from more traditional instruments such as the 300-foot telescope at Green Bank, West Virginia, which was lost so dramatically in November.

All but one of the chapters of the old edition are retained, but they are completely rewritten, sometimes by new authors. There are also some new chapters, covering new subjects such as astrochemistry and astrophysical masers, and a welcome chapter on the microwave cosmic background radiation. The one loss is the chapter "Interferometry and Aperture Synthesis," which still pro-

vides an excellent introduction to the subject. Its exclusion is understandable, as the book is about astrophysics rather than techniques (and experts will now refer to the recent fine monograph *Interferometry and Synthesis in Radio Astronomy* by A.R. Thompson, J.M. Moran, and G.W. Swenson—see the following review), but you may still wish to hold on to your copy of the first edition. Indeed one author refers the reader to his chapter in the first edition for more information!

Observations in astrophysics now span all wave bands, and a book devoted to the results from data gathered in just one wave band may seem parochial. But this volume will dispel such fears. The breadth of material covered makes the book essential reading for graduate students and practicing astronomers, and not just those whose specialty is radioastronomy. The 21 contributing authors are all active researchers in the areas of which they write, and for the most part the book is authoritative, thorough and well balanced. The chapters cover their topics at the level of advanced undergraduate and graduate courses, and include many references and well-chosen suggestions for further reading. With an average chapter length of 50 pages, the discussions are sufficiently deep to make this a useful source book, and for some years it will be the first place to turn for background on areas outside one's area of specialization.

The first 11 chapters cover galactic astronomy, including diffuse emission, supernova remnants, pulsars and other radio stars, while the final 4 chapters deal with extragalactic astronomy and cosmology. With a multiple-author volume it is difficult to maintain a uniform depth, but on the whole the editors have done an excellent job. We are disappointed that the subject of radio galaxies and quasars, which could fill an entire volume by itself, is here given only a single chapter. We also wonder why the editors chose to divide the discussion on molecules into two chapters, and whether the first two sections in "Interstellar Molecules and Astrochemistry" would not be better placed in the chapter "Molecules as Probes of the Interstellar Medium and of Star Formation."

In addition to being well-written and edited, this book—a volume in Springer-Verlag's *Astronomy and Astrophysics* series—has been carefully produced by the publisher, with pleasant typography (unfortunately not without occasional errors), copious illustrations and many black-

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and-white radio images. Radio-astronomy has become the equal of optical astronomy in the range and quality of astronomical information it makes accessible.

TIMOTHY J. PEARSON
ANTHONY C. S. READHEAD
*Owens Valley Radio Observatory
California Institute of Technology*

Radiotelescopes

W. N. Christiansen and
J. A. Högbom
*Cambridge U. P.,
New York, 1987 [1985].
Second edition. 265 pp.
\$24.95 pb ISBN 0-521-34795-5*

Interferometry and Synthesis in Radio Astronomy

A. Richard Thompson,
James M. Moran and
George W. Swenson Jr
*Wiley, New York, 1986. 534 pp.
\$59.95 hc ISBN 0-471-80614-5*

Tools of Radio Astronomy

Kristen Rohlf
*Springer-Verlag, New York,
1986. 319 pp.
\$62.00 hc ISBN 0-387-16188-0*

Exploration of astrophysical sources with the five decades of the electromagnetic spectrum between 100 m and 1 mm requires a wide variety of techniques, which are unified in the field of radioastronomy.

Radioastronomy developed in three phases. Before World War II the pioneers, Karl Jansky and Grote Reber, detected the first radio signals from beyond the solar system. The development of radar during the war led to a rapid expansion of the field afterwards, when scientists returned to their academic institutions. The third phase began in the 1960s, when sophisticated multiple-aperture telescopes were developed that could provide radioastronomers with resolutions exceeding the highest resolution of optical telescopes. The three books reviewed here provide texts for the modern student and researcher.

Radiotelescopes by W. N. Christiansen and J. A. Högbom is an attractively printed and welcome second edition of a classic 1969 monograph on the variety of antenna systems that have been developed for radioastronomy. Most of the chapters differ little from those of the first edition. The introduction, which summarizes the scientific needs that motivate the in-

strumental developments, and the chapter on aperture synthesis have been extensively revised, to reflect the developments in the past two decades.

The properties of filled-aperture antennas, especially the popular parabolic reflector, receive very thorough treatment. This includes the effect of aperture illumination on antenna pattern and the effect of surface imperfections caused by manufacturing errors and by gravitational, thermal and wind forces. There is discussion of the advantages and disadvantages of prime focus and Cassegrain feeds and the different mountings of antennas. While the authors suggest that spherical reflectors with aberration corrections may be important in the future, they do not describe the Gregorian reflector solution that is proposed for the US National Astronomy and Ionosphere Center's 1000-ft spherical reflector at Arecibo, Puerto Rico.

The especially valuable concept of the antenna as a spatial filter is introduced in the sections on correlation telescopes, whose apertures are largely unfilled. The idea of spatial frequencies is explained naturally through the use of the Fourier transform. This presentation unifies the discussion of the very diverse instruments that have been built: the grating arrays, the crosses, the Tees, the rings and the basic aperture-synthesis arrays. Christiansen himself developed many of these designs. The Fourier transform concept not only helps to explain these various instruments but also gives the reader an essential tool for the design of new antenna systems.

In the nearly 20 years since the appearance of the first edition, the majority of new high-resolution instruments have been interferometers that carry out Earth rotation synthesis. The trend has been away from hardware image formation to computer image processing and enhancement. The development of powerful general purpose computers has enabled many important advances. Mapping with dynamic ranges better than 1000:1 is now commonplace, as is the achievement of excellent maps with the very sparse sampling obtained with very-long-baseline interferometry. *Radiotelescopes* contains a clear discussion of the effects of irregular sampling and of the various image processing techniques that have been invented to remove confusing instrumental effects from radio maps. The presentation would be improved by more examples. Image processing is the area in which there have been the greatest recent technical advances in radioastronomy. The

lack of detail is all the more surprising because Högbom wrote the seminal paper (*Astrophys. J. Suppl.* 15, 417, 1974) in this area.

Interferometry and Synthesis in Radio Astronomy by A. Richard Thompson, James M. Moran and George W. Swenson Jr is a comprehensive account of techniques, written by three highly respected practitioners. Much of this material is not available in any other text, and many of the topics are treated at a level that is otherwise available only in journal articles, or, as the authors mention in their preface, in unpublished reports, observatory memoranda and lecture notes. What the readers do not find in this text, they will find in the extensive bibliographies and reference lists that follow each chapter.

The emphasis in Thompson, Moran and Swenson's book is on many aspects of the two-element radio interferometer. Half of the book develops an analytic description of the response of a pair of radiotelescopes to a distribution of partially polarized electrical noise signals on the celestial sphere. A measure of the detail to be found in these chapters is illustrated by the description of the effects on measurements of the offset between the two rotation axes of some telescopes. The authors cover both the propagation of the signals through the individual antenna elements and the correlation of signal pairs. They concentrate on techniques now in use on cm- and mm-wavelength interferometer arrays.

While Thompson, Moran and Swenson present the topic of aperture synthesis by Earth rotation and by physical movement of telescopes in greater detail than Christiansen and Högbom, their sections on synthesis are slight when compared with the effort that users expend in wrestling with data. However, other accounts, such as review articles, conference proceedings and observatory handbooks, deal with these topics.

Very-long-baseline interferometry is a frontier of development today, with the Very Long Baseline Array now under construction by the National Radio Astronomy Observatory and corresponding efforts proceeding around the globe. The field has progressed through many phases as the fundamental possibilities of correlating signals from observatories without a real-time connection were realized by detailed analysis and implementation. The techniques of interferometry and synthesis that are special to VLBI are succinctly presented.

One of the highlights of the book is the chapter on propagation, which