

Bookshelf



BCS: 50 Years

By Leon N Cooper and Dmitri Feldman (eds.)

World Scientific

Hardback: £84 \$135

Paperback: £40 \$65

More than 50 years after John Bardeen, Leon Cooper and Robert Schrieffer – BCS – published their now famous theory of superconductivity, and 100 years since the discovery of superconductivity, the key concepts have become the basis of a vast and ever-increasing field of investigation, both theoretical and experimental.

This exceptionally well written and edited book celebrates and reviews the state of BCS theory and experiment. The many chapters on the history and early experiments (written by Bardeen, Cooper, and Schrieffer, as well as others) are all very clear and readily accessible to a high-energy physicist, despite containing a wealth of detail. The content continues well beyond the usual applications of BCS theory and there are extensive discussions of extensions of BCS, especially in the light of attempts to understand the new high T_c superconductors.

Experimentalists will especially enjoy the chapter by John Clarke on “SQUIDS: Then and Now”, which contains a beautiful discussion of the early development of the superconducting quantum interference device (SQUID), including some really makeshift laboratory set-ups. I particularly enjoyed his description of trying to get a

thin, mechanically stable insulating film for a Josephson junction and his colleague Paul Wraight saying: “How about a blob of solder on a piece of niobium wire? Solder is a superconductor and you keep telling me that niobium has a surface oxide layer.” Remarkably this simple idea worked, with several junctions formed on the crude device. Brian Pippard quipped that it looked as though a slug had crawled through the window overnight and died, and so the term SLUG came into use for what was dubbed a “superconducting low-inductance undulatory galvanometer”. The chapter goes on to cover applications including magnetocardiography, magnetoencephalography, precision gyroscopes, geophysics, qubits, and searches for galaxy clustering and axions.

There is plenty in this book for the particle physicist: Gordon Baym covers BCS theory for atomic nuclei, neutron stars and quark matter; Yiochiro Nambu discusses mass gaps and symmetry breaking; Frank Wilczek writes on BCS theory in QCD at high densities and gives a particularly nice discussion of colour-flavour locking, as well as abelian and nonabelian anyons. In the final chapter Steven Weinberg gives a personal overview “From BCS to the LHC” (CERN Courier January/February 2008 p17).

All 23 chapters are by outstanding physicists (including many Nobel prize-winners) and all were fascinating to read. I would highly recommend this book to anyone and everyone as a wonderful review of a powerful unifying concept that covers an enormous range of phenomena.

● John Swain, Northeastern University.

Books received

Exact Methods in Low-Dimensional Statistical Physics and Quantum Computing: Lecture Notes from the Les Houches Summer School: Volume 89, July 2008

By Jesper Jacobsen, Stephane Ouvry, Vincent Pasquier, Didina Serban and Leticia Cugliandolo (eds.)

Oxford University Press

Hardback: £45 \$85

Recent years have shown spectacular convergences between traditional techniques in theoretical physics and methods emerging from modern mathematics, such as combinatorics, topology and algebraic geometry. These

techniques, and in particular those of low-dimensional statistical models, are instrumental in improving the understanding of emerging fields, such as quantum computing and cryptography, complex systems, and quantum fluids. This book sets these issues into a larger and more coherent theoretical context than is currently available, through lectures given by international leaders in the fields of exactly solvable models in low-dimensional condensed matter and statistical physics.

Lectures on light: Nonlinear and Quantum Optics using the Density Matrix

By Stephen C Rand

Oxford University Press

Hardback £39.95 \$75

This book attempts to bridge in one step the enormous gap between introductory quantum mechanics and the research front of modern optics and scientific fields that make use of light. Hence, while it is suitable as a reference for the specialist in quantum optics, it will also be useful to non-specialists from other disciplines. With a unique approach it introduces a single analytic tool, the density matrix, to analyse complex optical phenomena encountered in traditional as well as cross-disciplinary research. It moves from elementary to sophisticated topics in quantum optics, including laser tweezers, laser cooling, coherent population transfer, optical magnetism and squeezed light.

NIST Handbook of Mathematical Functions

By Frank W J Olver, Daniel W Lozier, Ronald F Boisvert and Charles W Clark, (eds.)

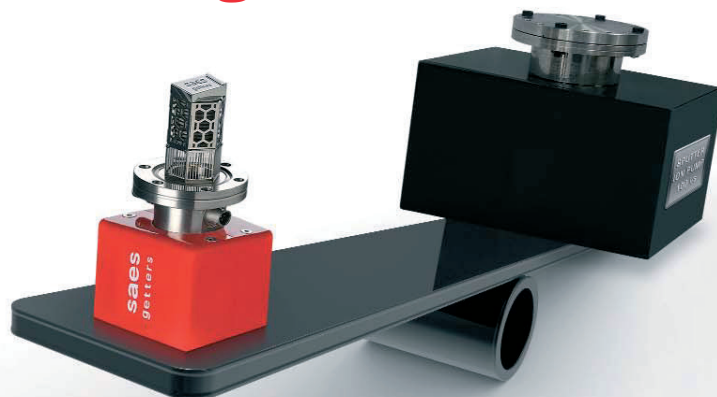
Cambridge University Press

Hardback £65 \$99

Paperback £35 \$50

Modern developments in theoretical and applied science depend on knowledge of the properties of mathematical functions, from elementary trigonometric functions to the multitude of special functions. Using them effectively requires practitioners to have ready access to a reliable collection of their properties. This handbook results from a 10-year project conducted by the National Institute of Standards and Technology with an international group of expert authors and validators. Printed in full colour, it is destined to replace its predecessor, the classic but long-outdated *Handbook of Mathematical Functions*, edited by Abramowitz and Stegun. It includes a DVD with a searchable PDF of each chapter.

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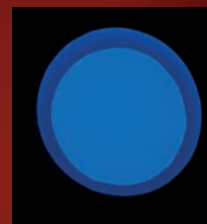
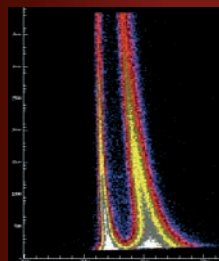


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