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Dynamics of Josephson Junctions and Circuits

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to implement such a pictorial view, principally the Jost matrix, R matrix and multichannel quantum-defect methods. They show how other approaches, for example, close-coupling methods, are incorporated in this formalism. The subject matter of part C, multichannel phenomena, is very complex but its understanding is facilitated by the treatment in part B of exclusively single-channel phenomena. This preliminary section is written very clearly and simply and gives the book great pedagogical value. Nevertheless, extraction of the maximum gain from the material often requires algebraic effort on the part of the reader. This is a book to be used; it is not a book for a casual reader. These two sections of the book are a major contribution to the field.

Part A is entitled "Perturbation Theory" but is restricted to a discussion of single-photon absorption and fast collisions with structureless charged projectiles. The treatment is limited to the first Born approximation. The authors adopt the point of view that the theory is only well understood in the low- and high-energy regimes. However, some attempts to cast higher-order perturbation methods for collisions within the language of parts B and C might have been useful.

The last section, part D, is devoted largely to the fundamental problem of electron correlation, the motion of two highly excited electrons around a positive core. The theoretical description of such states proceeds by a representation in terms of hyperspherical coordinates. A full and illuminating account of the successes of this powerful method is given. The subject is presented clearly, and again the authors emphasize the physical insight into the dynamics of these resonances afforded by the hyperspherical picture. However, no account of the large body of work on earlier or alternative treatments of doubly excited states is given. A reader not conversant with the field may obtain a somewhat unbalanced view of the situation. Nevertheless this is a fine account of the progress made through application of hyperspherical methods. The study of multiparticle excitations, their resonance formation and pathways of fragmentation is largely unexplored territory in atomic and molecular physics and will be an important direction for research effort in the years to come.

In summary, this book is a major addition to the atomic physics library. The central sections contain the elements of the modern, unified approach to electron–atom collisions and atomic spectra and point the way to general application in the theory of more complex atomic and molecular collision processes. This book should be in the toolbox of every graduate student in atomic physics, both theorist and experimenter.

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Dynamics of Josephson Junctions and Circuits

Konstantin K. Likharev
Gordon and Breach, New York, 1986. 614 pp. $170.00 hc
ISBN 2-88124-042-9

The Josephson effect in superconductors has, since its discovery in the 1960s, been the focus of great interest both because of its implications for fundamental questions in physics and because of its potential applications in certain areas of electronics, where it promised significant increases in device speed and sensitivity. By far the largest research effort using the Josephson effect has been an attempt to develop Josephson junctions as high-speed (picosecond) switches for digital applications. The emphasis is now shifting to analog applications, and in fact the most important successes of the Josephson effect have been in analog devices, namely the voltage standard and SQUID magnetometers and millimeter and submillimeter mixers (SIS detectors), where quantum-limited sensitivity is being approached.

Konstantin Likharev's latest book, *Dynamics of Josephson Junctions and Circuits*, should be of great interest to researchers working on Josephson effect devices, particularly those interested in analog applications. Likharev is at present head of the Laboratory for Cryoelectronics at Moscow State University. He has for years been one of the leading theorists working on the Josephson effect, during which time he has had a prodigious output and developed an encyclopedic knowledge of the field.

This book is very much focused around Likharev's own research interests, namely the microwave and noise properties of Josephson junctions. Indeed the bulk of the book is devoted to quantum interference and microwave properties, including the effects of noise, which are important for understanding the sensitivity limits of devices. This is just the current area of growing device research interest (leaving aside the new high-temperature superconductors).

A great strength of this book is its focus on mathematical techniques for obtaining analytical results using various models of the Josephson junction. It is surely the most complete compendium of such results available. This approach is nicely supplemented by graphs from computer simulations and results from other workers where appropriate. While all of the results presented show the strong imprint of Likharev's style, the book nonetheless serves as an excellent guide to other work in the field, with references to papers by about 1500 authors. The detail and focus make the book much better suited as a reference for workers in the field than as an introductory text, for which purpose a book such as *Principles of Superconductive Devices and Circuits* by Theodore Van Duzer and Charles Turner (Elsevier, New York, 1981) would serve better.

Dynamics of Josephson Junctions and Circuits fills a gap in the literature and presents much information not available in other books. It is an essential reference for researchers.

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Intellectual Mastery of Nature: Theoretical Physics from Ohm to Einstein

Christa Jungnickel and Russell McCormmach
U. of Chicago P., Chicago, 1986. 350 + 435 pp.

Vol. 1: The Torch of Mathematics, 1800–1870
$55.00 hc ISBN 0-226-41581-3

Vol. 2: The Now Mighty Theoretical Physics, 1870–1925
$65.00 hc ISBN 0-226-41584-8

At the beginning of the 19th century physics had little place in the curriculum and research of German-language universities. Natural science was part of the philosophical faculty and existed mainly to serve the needs of medical students. Professors of physics usually had to buy their own instrument collections, and the experimental and theoretical lectures were distinguished by whether the instructor used equipment or only a blackboard. As is well known, the profound changes in physical theory that took place early in the current century were in large measure the