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Book Review: *Quantum Statistical Theory of Superconductivity*

Quantum Statistical Theory of Superconductivity, Shigeji Fujita and Salvador Godoy, Plenum Press, New York and London, 1996.

If one decides to sum up the greatest achievements of twentieth century physics, three fields come to mind. These fields—quantum theory, relativity and deterministic chaos—have had a profound impact on the way that we think about the physical world. Closely trailing these three areas of physics superconductivity can be regarded as the single most interesting phenomenon in the physics of the twentieth century. This is demonstrated, for example, by four Nobel Prizes awarded for research in this field (Kamerlingh Onnes, 1911, Josephson, 1956, Bardeen, Cooper and Schrieffer, 1972, Bednorz and Muller, 1987). It is not surprising, therefore, that the stream of "superconducting" books has not yet diminished.

The features peculiar to the book under review are foreshadowed already in the book's title. These features, indeed, appear from place to place, such as the use of a generalized BCS Hamiltonian which explicitly considers the bond structure of electrons and phonons (Chapter 8), the consideration of Coopers pairs as massless bosons which allows a third order phase transition in two dimensions (Chapter 9), excited pairs versus quasielectrons as elementary excitations (Chapter 10), and some others. My general impression, however, is that the statistical mechanical approach developed by Fujita and his collaborators may have no more than some slight logical and methodological advantage over the more familiar BCS theory.

Therefore, this book has to be considered as just one among many text-books on superconductivity designed, according to the authors, to be "a one-semester course for beginning second year graduate students." However, as a text this book has some serious shortcomings. The authors have tried to squeeze into a textbook on superconductivity the equivalent of full courses in solid state physics and statistical mechanics. Despite the fact that the latter occupies more than half of the book, success in the

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fulfillment of such a challenge is, of course, unrealizable. Of no help to the student is the strange idea of including as part of the problems, derivations of mathematical formulae irrelevant to the understanding of high-temperature superconductors, subjects which are covered in twelve pages, and to type-2 superconductors, to which only seven pages are devoted.

It seems to me that this book would be unsatisfactory as a textbook on superconductivity. This is a great pity, since the style of this book, similar to that in previous books by Fujita, is very clear, with many interesting comments scattered throughout the book. Teachers and scientists working in solid state physics and other fields will find many interesting ideas and analogies, if they are patient enough to make their way through the variety of subjects which have been touched upon.

My recommendation for the next edition would be to greatly expand the materials dealing with superconductivity and in particular with modern developments in the research area, at the cost of deleting general information which is readily accessible in many excellent texts.

Moshe Gitterman
Department of Physics
Division of Computer Research and Technology
Bar-Ilan University
Ramat-Gan, Israel 52900