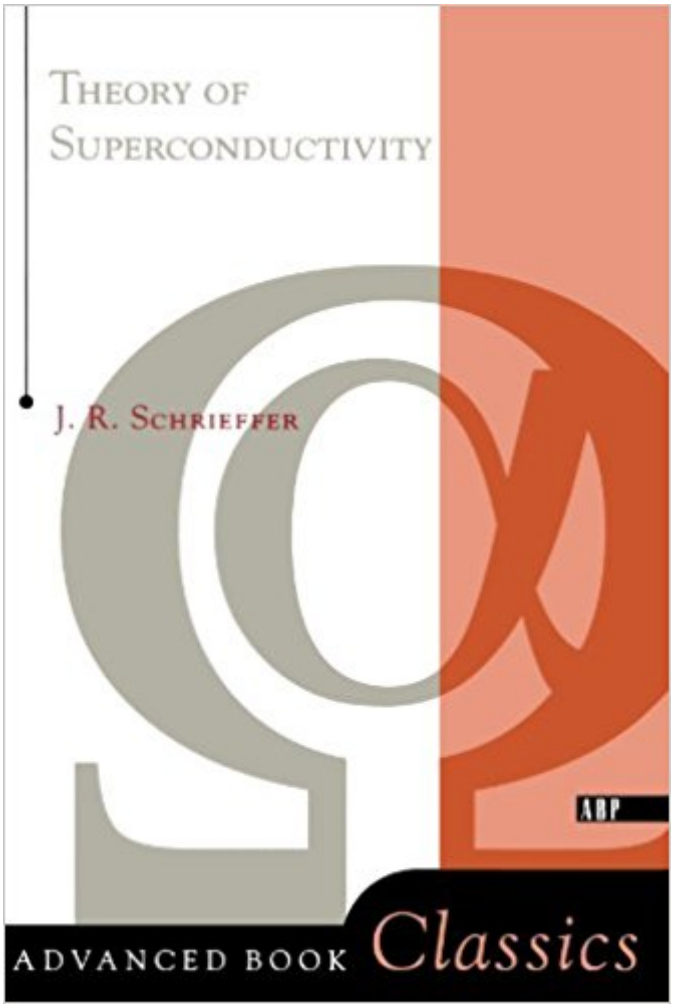
Theory Of Superconductivity (Advanced Books Classics)



Synopsis

Theory of Superconductivity is considered one of the best treatment of the field. This monograph, by Nobel Prize-winning physicist J. Robert Schrieffer, has been reprinted because of its enduring value as an introduction to the theory of superconductivity. The fundamentals of the theory of superconductivity are stresses as a means of providing the reader with a framework for the literature in which detailed applications of the microscopic theory are made to specific problems. It also serves as a foundation for the more recent development in this active field.

Book Information

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Customer Reviews

J. Robert Schrieffer received his B.S. from MIT. He continued his studies at the University of Illinois, where he along with Professors John Bardeen and Leon Cooper developed the theory of superconductivity. He continued his work as a fellow at the University of Birmingham and the Niels Bohr Institute in Copenhagen. Following work at the Universities of Chicago and Illinois, Schrieffer won the Nobel Prize, in 1972, for his work in superconductivity, sharing the honor with Bardeen and Cooper. He was a professor of physics at the University of California, Santa Barbara, and is now at the University of Florida, Tallahassee.

An excellent Physics book written in 1964 by one of the Nobel Laureate originators of the BCS theory, but by now out of date history.

John Schieffer’s book was written for solid state physicists with more than just a casual interest in superconductivity. The discussion of Cooper pairs, the foundation for BCS theory, though not difficult to read, is easier to understand after going through Gordon Baym’s discussion of this topic inÂ Lectures On Quantum Mechanics (Lecture Notes and Supplements in Physics). Much of this book is at a much higher level and only understandable to those with a solid grounding in quantum field theory.Although somewhat cryptic in places, many important details are included in this book--especially those that relate to BCS theory. I found a useful nugget of information in a reference to P.W. Anderson’s concept of pseudo-spin in superconductivity. The commutation relations for pseudo-spin are given on p.38, equations 2-21a, b, and c. Schrieffer’s reference #47 (p.270) directs the reader to Anderson’s papers that address this topic [Phys. Rev. 110,827(1958); 112,1900,(1958)] and give explicit expressions for the equivalent Pauli spin operators. Also of special interest are the Feynman diagram and accompanying Green’s function for the electron-phonon interaction (pp.126-136).It is certainly valuable to have this record of Schrieffer’s thoughts. I once had the opportunity to hear Schrieffer give an invited talk at a conference. He began with an amusing story of his early days as a graduate student at University of Illinois. One of his first tasks was to evaporate a film in a bell jar. Somehow this operation resulted in a small conflagration that burned off the hair on Schrieffer’s eyebrows and forehead. After his Ph.D. adviser John Bardeen learned of the unfortunate consequences of this experiment, Bardeen said to Schrieffer "maybe you should try doing theory."There is a story told by a University of Illinois physics professor that also pointed to theory as a likely career for the young John Schrieffer. The professor was active in high-energy particle physics and taught the course on that topic which was mandatory for all first year physics graduate students. The professor was in the habit of structuring his exams such that it consisted of three standard problems, as well as an additional extra credit problem. The extra credit problem usually addressed an aspect of the professor’s research in theoretical particle physics--and posed a question for which the professor had not yet found an answer! On the day of the exam the professor was surprised to find that Schrieffer breezed through the exam in only fifteen minutes when a full hour was allotted for jotting down one’s answers in the standard text booklet. Upon going through Schrieffer’s booklet, the professor was shocked to discover that not only did this remarkable student correctly answer the three standard questions in record time, he also gave a correct solution to the research problem that had been frustrating the professor for several years! The professor confessed to students attending his class twenty years later in the mid 1970’s that he had felt pretty stupid to be bested by a neophyte graduate student in this way--but was later quite

relieved when he heard that Schrieffer’s graduate work earned him a Nobel Prize!

Schrieffers’s book is valuable not only to study the theory of the superconductivity in the field theoretic language, but also to learn the normal Fermi liquid state by using Green’s functions. Actually the chapter on the introduction to Green’s function is really good, and a very concise discussion on RPA results and plasmon theory are given there. While bit dated, this text is still recommneded for every condensed matter students.Three nobel recutures by each of "BCS" are also given at the end of the book.

Although the material in the book is a little bit old, I still think it’s a good text book if you are the beginner in learning superconductivity. Pretty awesome!!