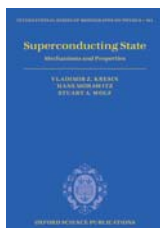


conducting State: Mechanisms and Properties. Authors Vladimir Kresin, Hans Morawitz, and Stuart Wolf present an up-to-date and comprehensive review of theory and experiments related to key features of superconductivity in conventional and new materials. They discuss mechanisms of superconductivity based on lattice, magnetic, and electronic degrees of freedom, and they analyze relevant experiments based on those models. More of a topical review than a systematic textbook, *Superconducting State* focuses on mechanisms of superconductivity and the related spectroscopies and omits such subjects as vortex physics and Josephson tunneling. That concentration is an advantage; with its restricted scope and modest size, the book will be accessible to everyone involved in the physics of superconductivity and magnetism.

Superconducting State differs significantly from *Mechanisms of Conventional and High T_c Superconductivity* (Oxford University Press, 1993), a previous work by the same authors; the primary difference is the descriptions of new superconducting materials discovered and investigated since the first work's publication. Those new materials in-



clude iron-based pnictide and chalcogenide superconductors, magnesium diboride, and ruthenium cuprates. The authors compare specific features in the new materials with those known from the more well-studied cuprates and pay special attention to granular and homogeneous superconductors.

Other advantageous features include the presentation of several novel aspects of superconductivity, including multiband superconductors, the pseudogap state, and unusual isotope effects. I also particularly liked the theoretical sections, which are concise, clearly explained, and not overloaded with lengthy calculations. The book will be an inestimable resource for researchers and advanced students who are acquainted with many-body quantum theory, particularly the Green's function techniques. I would also highly recommend *Superconducting State* to physicists, chemists, and materials scientists involved in the investigation and development of superconducting materials and devices.

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Exploring Quantum Mechanics

A Collection of 700+ Solved Problems for Students, Lecturers, and Researchers

Victor Galitski, Boris Karnakov, Vladimir Kogan, and Victor Galitski Jr
Oxford U. Press, 2013. \$165.00
(912 pp.). ISBN 978-0-19-923271-0

I like to start my upper-level undergraduate quantum mechanics course with a quote from physicist David Griffiths: "I do not believe one can intelligently discuss what quantum mechanics *means* until one has a firm sense of what quantum mechanics *does*." *Exploring Quantum Mechanics: A Collection of 700+ Solved Problems for Students, Lecturers, and Researchers* by Victor Galitski, Boris Karnakov, Vladimir Kogan, and Victor Galitski Jr provides a wide range of opportunities to learn what quantum mechanics does through an impressive collection of solved problems.

The book originates from a smaller work assembled by Galitski and Kogan in the mid 1950s; that work was then expanded, 20 years later, by Galitski in

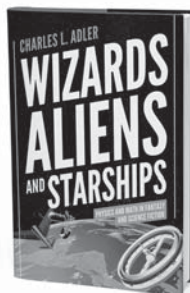
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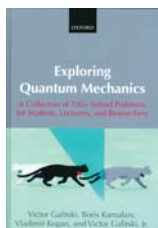
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collaboration with Karnakov. Alongside a highly productive research career, Galitski created the earlier work while struggling against political oppression under Joseph Stalin and the expanded version while fighting cancer of a more literal form. Three decades after the publication of the first Russian edition in 1981, his grandson, Galitski Jr, took on the long process of editing, translating, and expanding the problems. The result is a gem of old-world craftsmanship, well worth a place alongside the other classic texts of quantum mechanics in any physicist's library.

The problems cover topics in quantum mechanics at considerable depth, across a wide range of difficulty and sophistication. Some are simple exercises, many are suitable for advanced undergraduates, and the majority are suitable for the graduate level or beyond. Although I can't claim to have checked every problem and solution, the ones I sampled showed care and attention to detail. In a few cases I might have expanded on what the book provides in preparing a problem set or solution set for a class, but those problems tended to be the more straightforward ones; if such brevity allowed for more of the book's 912 pages to be devoted to detailed discussions of the more complex and subtle problems, it's a choice I wholeheartedly applaud.

Each chapter begins with a brief summary of key concepts and formulas, which serves as a useful reference for the subsequent problems and solutions. The presentation closely parallels a standard full-year graduate quantum mechanics course and provides a comprehensive range of problems for each topic. There is a particularly extensive selection of problems in atomic and nuclear physics, often connecting closely to experimental measurements. I was most impressed, however, by the sheer inventiveness and creativity required to formulate a wide range of problems that illuminate the many subtle facets of quantum mechanics but for which the calculations involved nonetheless remain tractable.

As Galitski Jr points out in the preface, this sort of thorough, detailed collection is a product of "people living and working in completely different times, and they were quite different from us, today's scientists: with their attention spans undiminished by constant exposure to email, internet, and television, and with their minds free of petty worries about citation counts, in-



stances, and rankings, they were able to devote 100% of their attention to science and take the time to focus on difficult problems that really mattered."

Ironically, where today's technology may have the most to offer to education is in managing large-scale collections of specialized knowledge of the sort found in this book. Although I'm doubtful about the value of the internet in replacing the teacher, I think it has a lot to offer toward upgrading the textbook, and I am frequently struck (especially while making up problem sets and exams) by how valuable it would be to assemble a large-scale online database of carefully crafted problems and solutions. Instructors around the world could contribute those cherished problems each of us has developed, typographical errors could be eliminated by crowdsourcing, and problems could be efficiently indexed by difficulty level and subject. All it would take to get such a project off the ground would be to assemble an initial critical mass of solved problems. Perhaps a member of the next generation will come along to take up that challenge.

Noah Graham
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Middlebury, Vermont

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