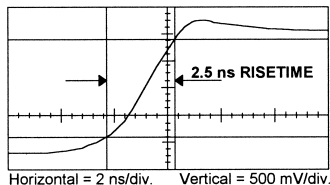
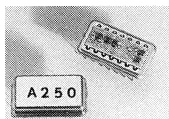


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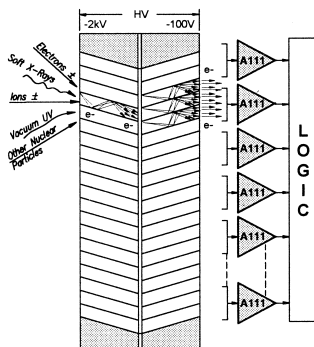
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theory of the magnetic vortices in a superconductor. Both can be related to the quantum theory of bosons in two dimensions. A recent paper quoted in the preface showed hexatic order in condensed DNA molecules.

The book provides an admirable overview of Nelson's achievements and of their relation to other work. All but one of the reviews are available in our library, but may not be available in smaller institutions. It is valuable to have all these contributions collected in one volume. I did not find the book easy reading, because often the articles concentrated on the details of what was then recent work, rather than on a broader perspective. There is also some repetition, and not quite enough linking material. I would have preferred a full-blown textbook giving the author's mature perspective, but that is too much to expect from the chair of a major physics department who has a vigorous research program.

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A Quantum Approach to Condensed Matter Physics

Philip L. Taylor and Olle Heinonen
Cambridge U. Press, New York,
2002. \$120.00, \$45.00 paper
(414 pp.). ISBN 0-521-77103-X,
ISBN 0-521-77827-1 paper.

The name "condensed matter physics" was coined in the 1960s to reflect the fledgling interest in the emergent, collective physics of matter and to distinguish it from the more restricted field of solid-state physics from which it had evolved. Few physicists could have foreseen the exciting discoveries, surprises, and radically new concepts and materials that came to light in condensed matter research during its first 40 years.

A great difficulty that students entering condensed matter physics face is a sparsity of up-to-date texts. Recently, a few superb modern texts have begun to appear, most notably Paul Chaikin and Tom Lubensky's *Principles of Condensed Matter Physics* (Cambridge U. Press, 2000) and Michael Marder's *Condensed Matter Physics* (Wiley, 2000). But students are still anxious for new texts to help them cope with the huge and rapidly developing field.

It was thus with great interest that I read *A Quantum Approach to Condensed Matter Physics*, by Philip Taylor and Olle Heinonen. The book is a modernized version of Taylor's earlier text,

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A Quantum Approach to the Solid State (Prentice-Hall, 1970). The authors deserve great credit for having labored to update the old text. Traditionally, solid-state physics and the collective effects of many-body interactions are treated in separate texts. Now, Taylor and Heinonen try to make condensed matter physics more accessible by molding the two approaches together in a single text. The book attempts to minimize the mathematical machinery, and claims to be accessible to students with a basic understanding of quantum mechanics.

The new text is ambitious in its breadth. It covers the basic concepts, including excitations and second quantization. Then it builds on those ideas to discuss a wide range of modern applications. Each of the book's 11 chapters is accompanied by a set of exercises, for which solutions are available on request from the publisher.

The book begins admirably. Its first chapter, devoted to elementary excitations, discusses traditional excitations (electron and phonon quasiparticles), and also plasmons, solitons (through the example of the one-dimensional Toda lattice), and the quantum Hall effect. The reader thus learns at the outset the importance of interactions in collective behavior. I was very encouraged. The next two chapters discuss Fermi and Bose fluids. After that introduction, the authors discuss one-electron theory, quasicrystals, and density-functional theory. I applaud the appearance, side by side, of density-functional theory and the notion of quasicrystals. From this point, the authors move on to consider interacting electrons.

Is this the condensed matter book our students have awaited? Unfortunately, no. In modernizing the book, the authors have added new material without devoting enough space to introduce key concepts. I was astonished to discover that the concepts of broken symmetry, order parameters, renormalization, and fixed points do not appear anywhere in the book. The omission of such ideas puzzles me, because those concepts are essential to physicists who attempt to describe the emergent behavior of collective matter.

The sections on Bose-Einstein condensation and superfluidity and the entire chapter on superconductivity, for example, never allude to broken symmetry or to the order parameter. Indeed, the student, having labored through the calculation of the Meissner effect, is not told about London's idea of wavefunction rigidity and will remain puzzled as to why a superconductor can expel magnetic fields. The section on mesoscopies omits the concept of quenched disorder and fails to

explain localization as a constructive interference between time-reversed paths. Lastly, the chapter on the Kondo model and heavy fermions does not explain the concept of a localized moment, nor does it mention renormalization or fixed points.

A Quantum Approach to Condensed Matter Physics will perhaps be of interest to students looking for a large cross section of modern condensed matter physics in a short text. The book has the merit of plentiful problems that cover a broad range of topics. However, the text is sorely wanting in many important respects,

and I regret that it fails to rise to the promise of its introductory chapters.

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Energy and the Environment

James A. Fay and Dan S. Golomb
Oxford U. Press, New York, 2002.
\$60.00 (314 pp.).
ISBN 0-19-515092-9

According to their preface, James Fay and Dan Golomb intended *Energy and*

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