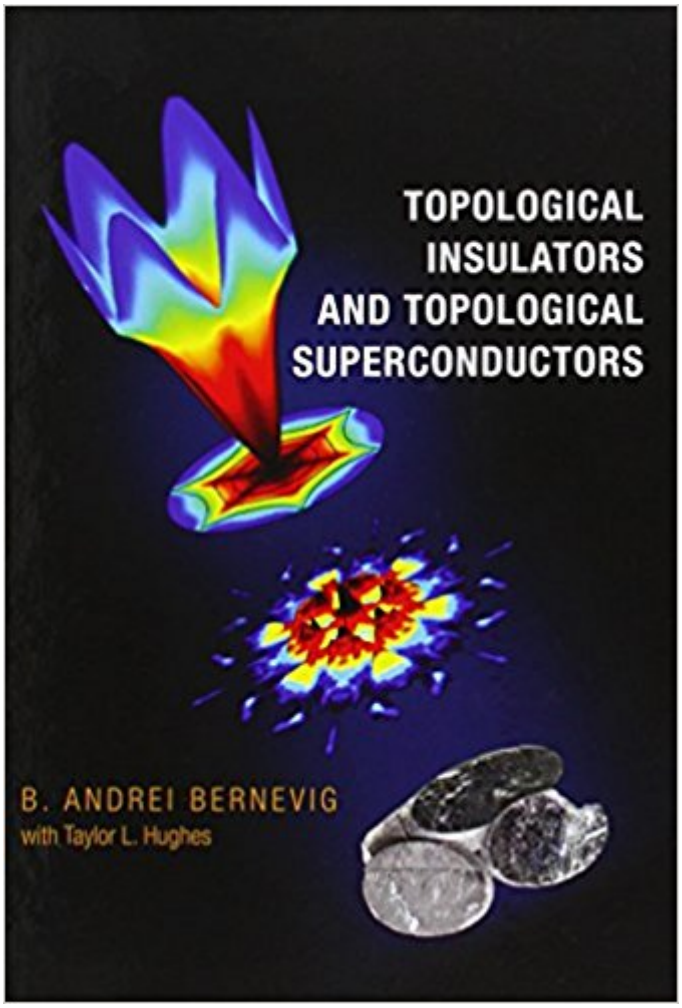
Topological Insulators And Topological Superconductors



Synopsis

This graduate-level textbook is the first pedagogical synthesis of the field of topological insulators and superconductors, one of the most exciting areas of research in condensed matter physics. Presenting the latest developments, while providing all the calculations necessary for a self-contained and complete description of the discipline, it is ideal for graduate students and researchers preparing to work in this area, and it will be an essential reference both within and outside the classroom. The book begins with simple concepts such as Berry phases, Dirac fermions, Hall conductance and its link to topology, and the Hofstadter problem of lattice electrons in a magnetic field. It moves on to explain topological phases of matter such as Chern insulators, two- and three-dimensional topological insulators, and Majorana p-wave wires. Additionally, the book covers zero modes on vortices in topological superconductors, time-reversal topological superconductors, and topological responses/field theory and topological indices. The book also analyzes recent topics in condensed matter theory and concludes by surveying active subfields of research such as insulators with point-group symmetries and the stability of topological semimetals. Problems at the end of each chapter offer opportunities to test knowledge and engage with frontier research issues. Topological Insulators and Topological Superconductors will provide graduate students and researchers with the physical understanding and mathematical tools needed to embark on research in this rapidly evolving field.

Book Information

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Customer Reviews

"The book . . . may be extremely useful to both graduate students and more senior researchers."--Vicentiu D. Radulescu, Zentralblatt MATH"Dr. Bernevig writes well and with insight. . . . with a beginning graduate student in mind who wants to enter quickly the research in this field."--S.W. Lovesey, Contemporary Physics

"This book presents an array of increasingly complicated problems centered around the idea of the topology of a band in k-space and the theorem that the Chern number determines the Hall effect. It will be invaluable to those who are in tune with the conceptual structure of modern band theory as reconfigured by Haldane and his fellow travelers."--Philip W. Anderson, Nobel Laureate in Physics"One of the most exciting developments in condensed matter physics over the last seven or eight years has been the topic of topological insulators and superconductors. The present book, by one of the original pioneers in this area, is a very up-to-date and comprehensive introduction to the theory of these systems. It will be extremely useful to both graduate students and more senior researchers."--Anthony J. Leggett, University of Illinois, Urbana-Champaign"An authoritative and sophisticated introduction to the mathematics of topological insulation."--Robert B. Laughlin, Stanford University"This book gives the first comprehensive introduction to the theory of topological insulators and superconductors--an exciting new field in condensed matter physics. The authors contributed to the discovery of the first topological insulator HgTe, and now present a readable account accessible to most graduate students."--Shoucheng Zhang, Stanford University"This excellent book introduces a relatively new topic in condensed matter physics. The material is well developed and sufficient detail is given for students to follow arguments and derivations. With a hands-on, no-nonsense approach, Topological Insulators and Topological Superconductors will be a mainstay in the field for years to come."--Marcel Franz, University of British Columbia"Topological Insulators and Topological Superconductors deals with a very exciting subject that has become the focus of research in recent years. Bernevig and Hughes have made some of the most important theoretical contributions to this young field and this timely volume will have significant staying power. It will be of great interest to condensed matter physicists, high energy and string theorists, and mathematicians."--Eduardo Fradkin, University of Illinois, Urbana-Champaign

This research area is exciting and growing dramatically. However, except the original research literatures, there are slim sources for people. especially graduate students to access this field. This book is indeed one of the pioneer textbooks and I did expect highly on it. But it disappointed me so much. I do not expect the really high quality such as Weinberg’s field theory or Ashcroft’s solid

physics. However, it is far from the standard quality... There are many typos in the book. I am able to correct many of them because most calculations in the book would be reproduced by myself. But some of them are not easy to determine, especially for some paradoxical and confusing definitions and conclusions. Even for the same calculation, there are two different answers from the author's deduction and citation from the literature source. I DO NOT recommend it. To understand this field or try to enter it later, I have to say, by now, the best way is to read the original academic papers and think hard by yourself.

The selection of content is very good, however, a pedagogical text must treat the material very carefully and it must be proofread many times. The abundance of mistakes and typos make it clear that this was not the case. It makes one mistrust the material rather than developing a crystal-clear understanding. Hopefully these will be fixed in a second edition!!

The book has many typos and is hard to read. The notation is awful and the authors do not care much about the reader.

A very rushed book. Does not cover subjects in depth.

This book has many typos, but somehow I find it very easy to follow after a few chapters

The book is clearly written and it is well illustrated. The author is well known in this field. All these aspects are both of big importance for a book on such novel branch of fundamental physics as topological insulators. Good choice both for researchers and graduate students!

A well written overview- survey of a field that is filled with controversy (or at least unfinished issues like time reversal symmetry) as well as potential, just beneath the surface. Prior to the publication of this text, there was no "go to" combination reference- text that covered the whole specialized field. You could go back to 2008- 2010 and other conferences, and especially search for keyword expert Shoucheng Zhang, Stanford's "world leading" researcher in this field, with work featured and referenced in many journal articles, as well as a major contributor toÃ Â Quantum Theory of Condensed Matter: Proceedings of the 24th Solvay Conference on Physics. In fact, Bernevig, Hughes and Zhang, known as BHZ in this field, were the first to propose a practical alternative (given temperature constraints) to graphene via HgTe and CdTe, as a theoretical model of the

practical possible existence of the quantum spin Hall state.Haldane et al have done a magnificent job of keeping the, at this writing, rapidly changing research up to date. Even so, there has been no previous graduate level text starting at the roots (which, excluding quantum computation basics such as the Hall effect, dating back to 1879, are only a decade old, with spin issues being researched beginning in 1990), and bringing us up to date on the most cutting edge algorithms, research, controversies and theories. Both insulators and superconductors are niches in topology that are now becoming whole careers (by topology I'm talking about sandwiches of materials practically, and the new state of quantum entanglement theoretically, not the math specialty alone, ie insulating on the inside/ conducting on the outside, etc.). As a physics and patent reviewer at payroy dot com, I see numerous new patent drafts in these two areas today. If you're a grad student on the horns of specialization dilemmas, this text will definitely give you enough of both overview and the specific math and physics to help you decide if this is your cup of tea. It truly is an all encompassing survey as well as reference, as well as text!The writing is quite good from a textual point of view, and with journal articles and symposium summaries added, could clearly become the centerpiece of a specialty graduate course in TI's, TS's or both. The authors don't hold back any punches on the computational complexity, but seem to be compassionate and experienced enough as teachers as well as researchers to have covered the basic learning building blocks. Not as friendly as an undergrad text, and not nearly as friendly as a self teaching text, the book nevertheless will appeal to a wide variety of both professors and researchers. If you are in the field, the references alone are well worth the price, as the authors took the time to reference a lot of computationally related books and articles that are a little broader than just TI's and TS's, to make this an excellent reference in quantum computational applications in general.Good balance of pure research and practical applications as well, at least from my limited, patent oriented viewpoint, plus you get 2/3 of the BHZ team all in one place. I'm sure any purchaser realizes that, from an "applications" viewpoint, most everything that combines the words quantum and room temperature are highly speculative in 2013. That doesn't, so you know, stop numerous IP hopefuls from submitting many new ideas, especially in what I'd roughly call materials science more than theoretical Physics! Other than quantum computing, the field has numerous other possible applications, ranging from the well known storage and display areas to far reaching implications in our "states of matter" assumptions, both within the cold parameters of topology and brand new material surrogates that bring the theory into more practical temperature ranges. That said, 95% of this text IS research, theory and computation oriented, due simply to the relatively young developmental stage of the field itself. The didactic piece is mainly in the ordering of presentation

from simpler to more complex, which doesn't detract from the reference or survey value at all.Library Picks reviews only for the benefit of shoppers and has nothing to do with , the authors, manufacturers or publishers of the items we review. We always buy the items we review for the sake of objectivity, and although we search for gems, are not shy about trashing an item if it's a waste of time or money for shoppers. If the reviewer identifies herself, her job or her field, it is only as a point of reference to help you gauge the background and any biases.

I can chose this textbook as a course without hesitation.it is clear, well written, and progressively self contained.I recommend it to any MS program in modern solid state physics

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