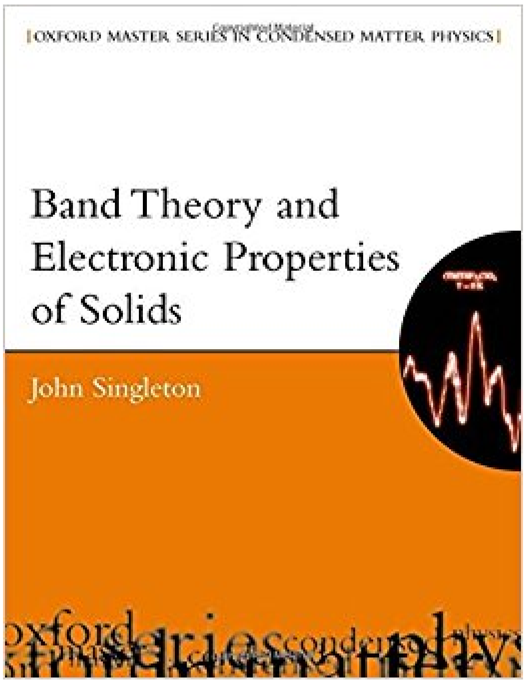
Band Theory And Electronic Properties Of Solids (Oxford Master Series In Physics)



Synopsis

This latest text in the new Oxford Master Series in Physics provides a much need introduction to band theory and the electronic properties of materials. Written for students in physics and material science, the book takes a pedagogical approach to the subject through the extensive use of illustrations, examples and problem sets. The author draws on his extensive experience teaching band theory to provide the reader with a thorough understanding of the field. Considerable attention is paid to the vocabulary and quantum-mechanical training necessary to learn about the electronic, optical and structural properties of materials in science and technology. The text also offers several chapters on the newest experimental techniques used to study band structure. Concise yet rigorous, it fills a long overdue gap between student texts and current research activities.

Book Information

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Customer Reviews

"This textbook for advanced physics and engineering students begins by introducing two tractable limits of Bloch's theorem in three dimensions, and demonstrates that both extreme limits give rise to bands with band gaps between them. Singleton (physics, Oxford) then explains semiconductors bands, the idea of artificial structures, techniques used to measure the bandstructures of solids, and recent research in the field."--SciTech Book News"The Oxford Master Series in Condensed Matter Physics offers an appealing alternative to conventional texts: a set of slim volumes, each on a separate topic and complete with exercises, written by active researchers who can combine a current perspective with the presentation of the relevant fundamental principles. ... The warm informality of the style makes us readers feel as if they were attending the lectures. ... this book is highly recommended. Its readable and enjoyable format will help students to develop an intuition for electronic properties."--Physics Today

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I found the appendices to be useful for references. The text and derivations in the main part are short on detail. So the main text is probably better suited as a quick guide reference for people that already have an understanding of the material. Or for those who really want to get a better understanding by working out all the derivations on their own.

This book is a good bridge between very abbreviated descriptions of solid state physics found in most EE semiconductor device books and a tome like Ashcroft and Mermin’s standard Solid State Physics book. It is mainly descriptive and elementary (the Boltzmann transport equation is barely mentioned). I like it because the author often plainly says useful things like the effective masses of electrons and light holes are similar, or that the heavy hole masses are pretty much the same for common semiconductors. The coverage of optical properties is minimal, apparently by design since the book is part of a series (Optical Properties of Solids by Fox).

As expected.

The text is pretty advanced but if you can trudge through it, you’ll have a beyond-grad level understanding of band theory. Especially useful for materials and semiconductor folks.

This book offers a pretty decent overview of band theory, but it’s woefully lacking in detail, especially in the later chapters, which seem to get progressively more qualitative. You shouldn’t rely on this book to give a thorough knowledge of band theory, but it’s worth reading. I think it would be especially useful when preparing for talks, because the explanations in the book are pretty easy to understand.

Said it was brand new, and it was.

In solid state/condensed matter physics, there is somewhat of a gap between introductory books and research papers on actually doing cutting edge work in band theory. Singleton attempts to remedy that with a text aimed squarely at honours-level students (in the UK), which is equivalent to senior level undergrads in the US.He starts with the simple Drude and Sommerfeld models. These are historically important, and also don’t need much in the way of computation. They could not have, actually, since they were devised at a time (pre-1940s), when electronic computers were unavailable. Singleton then quickly moves to the tight-binding model, which leads directly into modern band structure.From this, he shows how we get semiconductors and insulators. Then, how nowadays we can do better than nature. Instead of restricting ourselves to band structures of bulk compounds, we can synthesise heterostructures, and thus manipulate the resultant band structures in a quantitative fashion, giving novel and useful properties on a bulk scale.This might also motivate some readers to do research into such new materials.

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