

of 14 chapters, with a total of more than 40 contributing authors.

Chapter 1 introduces the general topology of skyrmions. Chapter 2 describes experimental approaches for magnetic domain observations from conventional methods to updated techniques, with a focus on currently adopted observation techniques for skyrmion investigations (including neutron scattering and Lorentz transmission electron microscopy), as well as the related theoretical issues (including the stability of magnetic skyrmions). Chapters 3–7

introduce several other experimental investigations of magnetic skyrmions through the use of techniques, including resonant x-ray scattering, Kerr microscopy, magnetic force microscopy, photo-emission electron microscopy, scanning electron microscopy, and spin-polarized electron microscopy. Chapters 8–10 discuss the dynamics of magnetic skyrmions, including field-driven motion, dynamical creation and distortion, and resonant excitation. Chapters 11–14 review the potential applications of magnetic skyrmions.

The figures and tables are adequate, and the references are up to date. The book does not include examples or problem sets. This publication is suitable for readers who are interested in condensed-matter physics, especially magnetism and electronics, both at an undergraduate and postgraduate level. It also can provide good guidance to those starting research on magnetic skyrmions.

**Reviewer: Mingzhong Wu** of the Department of Physics, Colorado State University, USA.



### Semiconductor Spintronics

Thomas Schäpers

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This book's clear physics diagrams and theoretical models on magnetic semiconductors and spintronics are impressive. It contains almost all of the new findings on spin-related carriers in different dimensionalities as well as quantum descriptions. It includes a comprehensive discussion on spin-related physical phenomena, their quantum expressions, and future applications, which will be very helpful for graduate students and those beginning research in this field. It can work as a textbook on spintronics for those majoring in condensed-matter physics, as spin physics becomes more important in the field. The exercises listed in each chapter are well presented and helpful. This book will also help expand the concepts of semiconductor spintronics to more people and facilitate more research on new spin-related concepts and devices.

After the introduction to the book in chapter 1, chapter 2 focuses on low-dimensional semiconductor structures.

Chapter 3 discusses magnetism in solids, and chapter 4 covers diluted magnetic semiconductors. Chapter 5 reviews magnetic electrodes. Chapter 6 focuses on spin injection; chapter 7 highlights the spin transistor; chapter 8 discusses spin interference; and chapter 9 covers the spin Hall effect. Chapter 10 reviews the quantum spin Hall effect. Chapter 11 describes topological insulators, and chapter 12 discusses quantum computation with electron spins.

Although this book is satisfactory, there are two areas that were omitted. It would have been useful for the book to cover spin-polarized excitations. In this rapidly growing field of research, spin-related carriers are not the only topic that should be covered. Optical techniques remain one of the most important tools to study magnetic semiconductors, but spin-related optical detection and application were not discussed. Perhaps these topics should belong to discussions of spin excitonics on spin photonics. Nonetheless,

spin-related exciton and spin-polarized optical behaviors, though having fewer publications on these topics, are also important both in concepts and applications. For example, the excitonic magnetic polaron and its extensions in polarized luminescence, photo-induced ferromagnetism in quantum dots or nanostructures, and spontaneous spin optical orientations and coherent optical behaviors, and possibly the collective magnetic exciton condensation are important.

Additionally, according to recent literature, more examples of ferromagnetic semiconductors have been found in non-doped compounds, whose existence may add some complexity in spintronic materials because defects may also find applications in future spintronic devices. A more explicit discussion of this in chapter 4 would have helped provide a more complete description of semiconductor spintronics. If the author plans a second edition, it would be useful to add some sections or information on the above subjects.

Although the book could be enhanced with the additions discussed previously, this is a good book for graduate students in solid-state physics and semiconductor devices.

**Reviewer: Bingsuo Zou** of the Beijing Institute of Technology, China.