Preface

Progress in modern technology is driven by the discovery of new material systems and physical interactions that improve the efficiency and functionality of devices. Many exciting developments have occurred in the past two decades with the potential to revolutionize the design of devices for future information and communication technologies, promoting reduced feature size, high storage density, and low-energy consumption.

One particularly fascinating class of materials that offers advanced functional properties is multiferroics. Multiferroics simultaneously exhibit two or more ferroic orders, such as ferroelectricity, (anti-)ferromagnetism and ferroelasticity, enabling unusual interactions between spin, charge, and lattice degrees of freedom. Although the rich physics associated with the interplay between coexisting ferroic orders has fascinated scientists since the first half of the 20th century, the field truly matured only over the last two decades. Today, a fundamental understanding of the complex microscopic interactions that give rise to multiferroicity is established and it has become clear how the new physical properties can be leveraged in devices. From a technological point of view, the emergence and coupling of electric and magnetic order in multiferroics is arguably the most appealing property as it enables the electric-field control of magnetism. This possibility represents the *holy grail* in the field. The related research has led a number of advances and ramifications in a broader context, providing a promising pathway towards low-energy control of magnetically stored information and the design of power-efficient electronic devices in general.

The goal of this book is to provide a state-of-the-art summary, serving as a comprehensive reference regarding key developments in the field of multiferroics and promising future research directions. Bringing together internationally leading researchers covering both experiment and theory, the book provides a historical perspective, a comprehensive overview about the fundamental properties of multiferroic materials, as well as insight into envisioned applications.

We hope that our book will inspire newcomers to explore the fascinating world of multiferroics and help the researchers active in the field to stay up to date regarding the recent developments, modern trends, and open challenges. We thank all authors for their commitment and excellent contributions that made this project possible. Thanks to them, and the outstanding quality of their chapters, this book gathers a remarkable expertise in the theoretical description, material design, characterization and device integration of multiferroic materials. We hope that you will enjoy reading about their perspectives on the research on multiferroics and possibly become curious to learn more about multiferroics.

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