1. Record Nr. UNINA9911018754203321

Autore	Shimizu Kotaro
Titolo	Spin Moiré Engineering and Emergent Electromagnetism in Topological Spin Crystals / / by Kotaro Shimizu
Pubbl/distr/stampa	Singapore : , : Springer Nature Singapore : , : Imprint : Springer, , 2025
ISBN	9789819659920
Edizione	[1st ed. 2025.]
Descrizione fisica	1 online resource (341 pages)
Collana	Springer Theses, Recognizing Outstanding Ph.D. Research, , 2190-5061
Disciplina	538
Soggetti	Magnetism Topological insulators Spintronics Topological Material
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	-- 1 Introduction -- 2 Spin moiré engineering -- 3 Model -- 4 Methods -- 5 Spin moiré engineering in one dimension -- 6 Spin moiré engineering in two dimensions -- 7 Spin moiré engineering in three dimensions -- 8 Summary.
Sommario/riassunto	This book presents a comprehensive theoretical investigation into the engineering of topological properties, emergent electromagnetic phenomena, and magnetic and electrical functionalities in materials with topological spin textures. In bulk magnets, topological spin textures like skyrmions form periodic arrangements called topological spin crystals, exhibiting unique magnetic properties and quantum transport phenomena due to their noncollinear and noncoplanar spin structures. A key challenge is the flexible generation, annihilation, and control of spin textures with different topology, which is crucial for next-generation devices. While previous studies addressed specific cases, a generic perspective was lacking. To enable a systematic approach, the author introduces the “spin moiré” picture, recognizing that topological spin crystals can be viewed as superpositions of multiple spin density waves. Moiré patterns arise from wave interference, exhibiting distinct periodicities from their constituents. Importantly, a variety of moiré patterns are realized in many ways by

changing many parameters, e.g., periods, amplitudes, phases, propagating directions, and the number of superposed waves. Given the analogy with the conventional moiré patterns, one can conceive a variety of spin patterns and their continuous modulations through the spin moiré picture. This analogy provides a versatile framework for controlling topological magnetism. Given the increasing importance of topology in understanding the states of matter, especially in magnetic materials, the insights in this book not only deepen the fundamental understanding of topological magnetism but also open new directions for exploring emergent electromagnetic phenomena and designing magnetic functionalities. Intended for students and researchers in condensed matter physics and materials science, this book is a valuable resource for those interested in both fundamental theory and advanced discussions on topological magnetism and its control. .