Topological Phases of Matter*

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(Dated: March 18, 2021)

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I. INTRODUCTION

II. REVIEW OF ELECTRONIC MATTER

Electronic matter [1] iss cool! [2, testi]. Another example [3, testi]

ORDER PARAMETERS AND LANDAU THEORY

TOPOLOGICAL PHASES OF MATTER

EXAMPLES AND CURRENT WORK

Appendix A: Details 1

Appendix A: Details 2

- [1] F. D. M. Haldane, Model for a Quantum Hall Effect without Landau Levels: Condensed-Matter Realization of the "Parity Anomaly", Physical Review Letters 61, 2015 (1988), publisher: American Physical Society (APS).
- [2] L. Fu, C. L. Kane, and E. J. Mele, Topological Insulators in Three Dimensions, Physical Review Letters 98, 10.1103/physrevlett.98.106803 (2007), publisher: American Physical Society (APS).
- [3] M. N. Barber, Phase transitions in two dimensions, Physics Reports **59**, 375 (1980), publisher: Elsevier BV.
- [4] L. Xin, Y. Siyuan, L. Harry, L. Minghui, and C. Yanfeng, Topological mechanical metamaterials: A brief review, Current Opinion in Solid State and Materials Science 24, 100853 (2020), publisher: Elsevier BV.
- [5] J. Bardeen, L. N. Cooper, and J. R. Schrieffer, Theory of Superconductivity, Physical Review 108, 1175 (1957), publisher: American Physical Society (APS).
- [6] P. Hohenberg and A. Krekhov, An introduction to the Ginzburg-Landau theory of phase transitions and nonequilibrium patterns, Physics Reports **572**, 1 (2015), publisher: Elsevier BV.
- [7] A. Haim and Y. Oreg, Time-reversal-invariant topological superconductivity in one and two dimensions, Physics Reports 825, 1 (2019), publisher: Elsevier BV.
- [8] D. Bradley, Nobel Prizes 2016, Materials Today 19, 553 (2016), publisher: Elsevier BV.
- [9] X.-G. Wen, Colloquium: Zoo of quantum-topological phases of matter, Reviews of Modern Physics 89,

- 10.1103/revmodphys.89.041004 (2017), publisher: American Physical Society (APS).
- [10] C. Zhang, H.-Z. Lu, S.-Q. Shen, Y. P. Chen, and F. Xiu, Towards the manipulation of topological states of matter: a perspective from electron transport, Science Bulletin **63**, 580 (2018), publisher: Elsevier BV.
- [11] Z. Hu, Z. Ma, Y.-D. Liao, H. Li, C. Ma, Y. Cui, Y. Shangguan, Z. Huang, Y. Qi, W. Li, Z. Y. Meng, J. Wen, and W. Yu, Evidence of the Berezinskii-Kosterlitz-Thouless phase in a frustrated magnet, Nature Communications 11, 10.1038/s41467-020-19380-x (2020), publisher: Springer Science and Business Media LLC.
- [12] A. G. Pithis and J. Thürigen, Phase transitions in group field theory: The Landau perspective, Physical Review D 98, 10.1103/physrevd.98.126006 (2018), publisher: American Physical Society (APS).
- [13] M. Z. Hasan and C. L. Kane, Colloquium: Topological insulators, Reviews of Modern Physics 82, 3045 (2010), publisher: American Physical Society (APS).
- [14] J. E. Avron, D. Osadchy, and R. Seiler, A Topological Look at the Quantum Hall Effect, Physics Today 56, 38 (2003), publisher: AIP Publishing.
- [15] C. L. Kane and E. J. Mele, Z2Topological Order and the Quantum Spin Hall Effect, Physical Review Letters 95, 10.1103/physrevlett.95.146802 (2005), publisher: American Physical Society (APS).
- [16] R. B. Laughlin, Quantized Hall conductivity in two dimensions, Physical Review B 23, 5632 (1981), publisher: American Physical Society (APS).
- [17] D. J. Thouless, M. Kohmoto, M. P. Nightingale, and M. Den Nijs, Quantized Hall Conductance in a Two-Dimensional Periodic Potential, Physical Review Letters 49, 405 (1982), publisher: American Physical Society

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- (APS).
- [18] M. Konig, S. Wiedmann, C. Brune, A. Roth, H. Buhmann, L. W. Molenkamp, X.-L. Qi, and S.-C. Zhang, Quantum Spin Hall Insulator State in HgTe Quantum Wells, Science 318, 766 (2007), publisher: American Association for the Advancement of Science (AAAS).
- [19] J. E. Moore and L. Balents, Topological invariants of time-reversal-invariant band structures, Physical Re-
- view B 75, 10.1103/physrevb.75.121306 (2007), publisher: American Physical Society (APS).
- [20] Y. Zhang, T.-T. Tang, C. Girit, Z. Hao, M. C. Martin, A. Zettl, M. F. Crommie, Y. R. Shen, and F. Wang, Direct observation of a widely tunable bandgap in bilayer graphene, Nature 459, 820 (2009), publisher: Springer Science and Business Media LLC.