

Xie Chen

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Academic Appointments

2019.11 – now	Professor	California Institute of Technology
2017.7 – 2019.10	Associate professor	California Institute of Technology
2014.7 – 2017.6	Assistant professor	California Institute of Technology
2012.8 – 2014.6	Miller research fellow	University of California, Berkeley

Education

2006.9 – 2012.7	Ph.D. in theoretical physics	Massachusetts Institute of Technology
2002.9 – 2006.6	B. Sc. in physics	Tsinghua University

Research Interest

Topological phenomena in strongly correlated quantum many-body systems.
Topics include: topological defects and non-invertible symmetry; fracton order; symmetry protected topological order; symmetry fractionalization; quantum dynamics and information scrambling; tensor network representation; quantum information applications.

Awards and Honors

2021 Simons Investigator
2020 New Horizon in Physics Prize
2018 APS Outstanding Referee.
2017 Caltech Graduate Student Council Excellence in Teaching Award.
2017 Sloan Research Fellowship.
2017 National Science Foundation Faculty Early Career Award.
2012 Miller Research Fellowships from the Miller Institute for Basic Research in Science of UC Berkeley.

Publications

Preprint

1. Avi Vadali, Zongyuan Wang, Arpit Dua, Wilbur Shirley, **XC**, “Composite subsystem symmetries and decoration of sub-dimensional excitations”, arXiv:2312.04467.
2. Nathanan Tantivasadakarn, **XC**, “String operators for Cheshire strings in topological phases”, arXiv:2307.03180.
3. **XC**, Arpit Dua, Michael Hermele, David T. Stephen, Nathanan Tantivasadakarn, Robijn Vanhove, Jing-Yu Zhao, “Sequential Quantum Circuits as Maps between Gapped Phases”, arXiv:2307.01267.
4. **XC**, Ho Tat Lam, Xiuqi Ma, “Ground State Degeneracy of Infinite-Component Chern-Simons-Maxwell Theories”, arXiv:2306.00291.
5. **XC**, Ho Tat Lam, Xiuqi Ma, “Gapless Infinite-component Chern-Simons-Maxwell Theories”, arXiv:2211.10458.

6. Max A. Metlitski, Lukasz Fidkowski, **XC**, Ashvin Vishwanath, “Interaction effects on 3D topological superconductors: surface topological order from vortex condensation, the 16-fold way and fermionic Kramers doublets”, arXiv:1406.3032.

Published

7. Zongyuan Wang, Xiuqi Ma, David T. Stephen, Michael Hermele, **XC**, “Renormalization of Ising cage-net model and generalized foliation”, *Phys. Rev. B* 108, 035148 (2023).
8. Xiuqi Ma, Ananth Malladi, Zongyuan Wang, Zhenghan Wang, **XC**, “Ground state degeneracy of the Ising cage-net model”, *Phys. Rev. B* 107, 085123 (2023).
9. **XC**, Arpit Dua, Po-Shen Hsin, Chao-Ming Jian, Wilbur Shirley, Cenke Xu, “Loops in 4+1d Topological Phases”, *SciPost Phys.* 15, 001 (2023).
10. Kevin Slagle, Yue Liu, David Aasen, Hannes Pichler, Roger S. K. Mong, **XC**, Manuel Endres, Jason Alicea, “Quantum spin liquids bootstrapped from Ising criticality in Rydberg arrays”, *Phys. Rev. B* 106, 115122 (2022).
11. Kevin Slagle, David Aasen, Hannes Pichler, Roger S. K. Mong, Paul Fendley, **XC**, Manuel Endres, Jason Alicea, “Microscopic characterization of Ising conformal field theory in Rydberg chains”, *Phys. Rev. B* 104, 235109 (2021).
12. Xiuqi Ma, Wilbur Shirley, Meng Cheng, Michael Levin, John McGreevy, **XC**, “Fractonic order in infinite-component Chern-Simons gauge theories”, *Phys. Rev. B* 105, 195124 (2022).
13. Kevin Slagle, David Aasen, Hannes Pichler, Roger S. K. Mong, Paul Fendley, **XC**, Manuel Endres, Jason Alicea, “Microscopic characterization of Ising conformal field theory in Rydberg chains”, *Phys. Rev. B* 104, 235109 (2021).
14. Nandagopal Manoj, Kevin Slagle, Wilbur Shirley, **XC**, “Screw dislocations in the X-cube fracton model”, *SciPost Phys.* 10, 094 (2021).
15. Sean Hartnoll, Subir Sachdev, Tadashi Takayanagi, **XC**, Eva Silverstein and Julian Sonner, “Quantum connections”, *Nat Rev Phys* (2021).
16. Wilbur Shirley, Kevin Slagle, **XC**, “Twisted foliated fracton phases”, *Phys. Rev. B* **102**, 115103 (2020).
17. Michael Pretko, **XC**, Yizhi You, “Fracton Phases of Matter”, *International Journal of Modern Physics A*, 35, 06, 2030003 (2020).
18. Taige Wang, Wilbur Shirley, **XC**, “Foliated fracton order in the Majorana checkerboard model”, *Phys. Rev. B* 100, 085127 (2019).
19. Wilbur Shirley, Kevin Slagle, **XC**, “Foliated fracton order from gauging subsystem symmetries”, *SciPost Phys.* 6, 041 (2019).
20. Wilbur Shirley, Kevin Slagle, **XC**, “Foliated fracton order in the checkerboard model”, *Phys. Rev. B* 99, 115123 (2019).
21. Wilbur Shirley, Kevin Slagle, **XC**, “Fractional excitations in foliated fracton phases”, *Annals of Physics*, 410, 167922 (2019).
22. Wilbur Shirley, Kevin Slagle, **XC**, “Universal entanglement signatures of foliated fracton phases”, *SciPost Phys.* 6, 015 (2019).
23. Yong-Liang Zhang, Yichen Huang, **XC**, “Information scrambling in chaotic systems with dissipation”, *Phys. Rev. B* 99, 014303 (2019).
24. Mehmet Burak Sahinoglu, Sujeet Shukla, Feng Bi, **XC**, “Matrix Product Representation of Locality Preserving Unitaries”, *Phys. Rev. B* 98, 245122 (2018).
25. Zitao Wang, Shang-Qiang Ning, **XC**, “Exactly Solvable Model for Two Dimensional Topological Superconductor”, *Phys. Rev. B* 98, 094502 (2018).

26. Wilbur Shirley, Kevin Slagle, Zhenghan Wang, **XC**, “Fracton Models on General Three-Dimensional Manifolds”, *Phys. Rev. X* 8, 031051 (2018).
27. Sujeet Shukla, Mehmet Burak Sahinoglu, Frank Pollmann, **XC**, “Boson condensation and instability in the tensor network representation of string-net states”, *Phys. Rev. B* 98, 125112 (2018).
28. Han Ma, Michael Hermele, **XC**, “Fracton topological order from Higgs and partial confinement mechanisms of rank-two gauge theory”, *Phys. Rev. B* 98, 035111 (2018).
29. Han Ma, Ethan Lake, **XC**, Michael Hermele, “Fracton topological order via coupled layers”, *Phys. Rev. B* 95, 245126 (2017).
30. Zitao Wang, **XC**, “Twisted gauge theories in 3D Walker-Wang models”, *Phys. Rev. B* 95, 115142 (2017).
31. **XC**, “Symmetry fractionalization in two dimensional topological phases”, *Reviews in Physics*, 2, 3, (2017).
32. Yi-Chen Huang, Yong-Liang Zhang, **XC**, “Out-of-time-ordered correlator in many-body localized systems”, *Ann. Phys. (Berlin)*, (2016).
33. **XC**, Michael Hermele, “Symmetry fractionalization and anomaly detection in three-dimensional topological phases”, *Phys. Rev. B* 94, 195120, (2016).
34. Michael Hermele, **XC**, “Flux-Fusion Anomaly Test and Bosonic Topological Crystalline Insulators”, *Phys. Rev. X* 6, 041006 (2016).
35. Fiona Burnell, **XC**, Alexei Kitaev, Max Metlitski, Ashvin Vishwanath, “Time reversal invariant gapped boundaries of the double semion state”, *Phys. Rev. B* 93, 235161 (2016).
36. **XC**, Ashvin Vishwanath, “‘Gauging’ time reversal symmetry in tensor network states”, *Phys. Rev. X* 5, 041034 (2015).
37. **XC**, Fiona J. Burnell, Ashvin Vishwanath, Lukasz Fidkowski, “Anomalous Symmetry Fractionalization and Surface Topological Order”, *Phys. Rev. X* 5, 041013 (2015).
38. Yi-Chen Huang, **XC**, “Quantum circuit complexity of one-dimensional topological phases”, *Phys. Rev. B* 91, 195143 (2015).
39. F. J. Burnell, **XC**, Lukasz Fidkowski, Ashvin Vishwanath, “Exactly Soluble Model of a 3D Symmetry Protected Topological Phase of Bosons with Surface Topological Order”, *Phys. Rev. B* 90, 245122 (2014).
40. **XC**, Yuan-Ming Lu, Ashvin Vishwanath, “Symmetry protected topological phases from decorated domain walls”, *Nature Communications* 5, Article number 3507 (2014).
41. **XC**, Lukasz Fidkowski, Ashvin Vishwanath, “Symmetry Enforced Non-Abelian Topological Order at the Surface of a Topological Insulator”, *Phys. Rev. B* 89, 165132 (2014).
42. Ching-Yu Huang, **XC**, Frank Pollmann, “Detection of Symmetry Enriched Topological Phases”, *Phys. Rev. B* 90, 045142 (2014).
43. Ching-Yu Huang, **XC**, Feng-Li Lin, “Symmetry Protected Quantum State Renormalization”, *Phys. Rev. B* 88, 205124 (2013).
44. Lukasz Fidkowski, **XC**, Ashvin Vishwanath, “Non-Abelian Topological Order on the Surface of a 3D Topological Superconductor from an Exactly Solved Model”, *Phys. Rev. X* 3, 041016 (2013).
45. **XC**, Fa Wang, Yuan-Ming Lu, Dung-Hai Lee, “Critical theories of phase transition between symmetry protected topological states and their relation to the gapless boundary theories”, *Nucl. Phys. B* 873, 248–259 (2013).
46. **XC**, Zheng-Cheng Gu, Zheng-Xin Liu, Xiao-Gang Wen, “Symmetry Protected Topological Orders in Interacting Bosonic Systems”, *Science* 338, 1604 (2012).

47. **XC**, Xiao-Gang Wen, “Chiral symmetry on the edge of 2D symmetry protected topological phases”, *Phys. Rev. B* 86, 235135 (2012).
48. Yu-Ju Chiu, **XC**, Isaac L. Chuang, “Fermionic Measurement-based Quantum Computation”, *Phys. Rev. A* 87, 012305 (2012).
49. **XC**, Zheng-Cheng Gu, Zheng-Xin Liu, Xiao-Gang Wen, “Symmetry protected topological orders and the group cohomology of their symmetry group”, *Phys. Rev. B* 87, 155114 (2011).
50. **XC**, Zheng-Xin Liu, Xiao-Gang Wen, “Two-dimensional symmetry protected topological orders and their protected gapless edge excitations”, *Phys. Rev. B* 84, 235141 (2011). (Editor’s Suggestion)
51. Zheng-Xin Liu, **XC**, Xiao-Gang Wen, “Symmetry protected topological orders of 1D spin systems with D2+T symmetry”, *Phys. Rev. B* 84, 195145 (2011).
52. **XC**, Zheng-Cheng Gu, Xiao-Gang Wen, “Complete classification of 1D gapped quantum phases in interacting spin systems”, *Phys. Rev. B* 84, 235128 (2011).
53. Samuel A. Ocko, **XC**, Bei Zeng, Beni Yoshida, Zhengfeng Ji, Mary Beth Ruskai, Isaac L. Chuang, “Quantum Codes give Counterexamples to the Unique Pre-image Conjecture of the N-representability Problem”, *Phys. Rev. Lett.* 106, 110501 (2011).
54. **XC**, Zheng-Cheng Gu, and Xiao-Gang Wen, “Classification of Gapped Symmetric Phases in One-dimensional Spin Systems”, *Phys. Rev. B* 83, 035107 (2011). (Editor’s Suggestion)
55. Jianxin Chen, **XC**, Runyao Duan, Zhengfeng Ji, and Bei Zeng, “No-go Theorem for One-way Quantum Computing on Naturally Occurring Two-level Systems”, *Phys. Rev. A* 83, 050301 (2011). (Rapid Communication)
56. **XC**, Zheng-Cheng Gu, and Xiao-Gang Wen, “Local Unitary Transformation, Long-Range Quantum Entanglement, Wave Function Renormalization, and Topological Order”, *Phys. Rev. B* 82, 155138 (2010). (Editor’s Suggestion)
57. **XC**, Bei Zeng, Zheng-Cheng Gu, Isaac L. Chuang, Xiao-Gang Wen, “Tensor Product Representation of Topological Ordered Phase: Necessary Symmetry Conditions”, *Phys. Rev. B* 82, 165119 (2010).
58. **XC**, Runyao Duan, Zhengfeng Ji, Bei Zeng, “Quantum State Reduction for Universal Measurement based Computation”, *Phys. Rev. Lett.* **105**(2), 020502 (2010).
59. **XC**, Bei Zeng, Zhengcheng Gu, Beni Yoshida, Isaac L. Chuang, “Gapped Two-body Hamiltonian whose Unique Ground State is Universal for One-way Quantum Computation”, *Phys. Rev. Lett.* 102, 220501 (2009). (Featured by synopsis on physics.aps.org)
60. **XC**, Bei Zeng, Isaac L. Chuang, “Nonbinary Codeword Stabilized Quantum Codes”, *Phys. Rev. A* 78, 062315 (2008).
61. **XC**, Hyeyoun Chung, Andrew W. Cross, Bei Zeng, Isaac L. Chuang, “Subsystem Stabilizer Codes cannot have a Universal Set of Transversal Gates for Even One Encoded Qudit”, *Phys. Rev. A* 78, 012353 (2008).
62. Bei Zeng, **XC**, and Isaac L. Chuang, “Semi-Clifford Operations, Structure of Ck Hierarchy, and Gate Complexity for Fault-Tolerant Quantum Computation”, *Phys. Rev. A* 77, 042313 (2008).
63. **XC**, Shuang Nan Zhang, Guo Qiang Ding, “Propeller Driven Spectral State Transition in LMXB 4U 1608-52”, *Astrophys.J.* 650, 299(2006).

Book

Book title: Quantum Information Meets Quantum Matter -- From Quantum Entanglement to Topological Phase in Many-Body Systems

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