Yi-Zhuang You, Ph. D.

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University of California at San Diego,
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Research Area

Theoretical condensed matter physics: correlated quantum many-body system, topological phases of matter, quantum entanglement and holography, machine learning and physics.

Education & Training

- B.Sc. Physics, Nanjing University (2004 - 2008)
- Ph.D. Physics, Tsinghua University (2008 - 2013)
- Postdoc, University of California, Santa Barbara (2013 - 2016)
- Postdoc, Harvard University (2016 - 2018)

Employment

- Assistant Professor, University of California, San Diego (2018 -)

Publications

Selected Articles:

[1] Yi-Zhuang You, Zhao Yang, Xiao-Liang Qi. *Machine learning spatial geometry from entanglement features*. Phys. Rev. B **97**(4), 045153 (2018).

[2] Yi-Zhuang You, Andreas W. Ludwig, Cenke Xu. *Sachdev-Ye-Kitaev model and thermalization on the boundary of many-body localized fermionic symmetry protected topological states*. Phys. Rev. B **95** (16) 165136 (2017).

[3] Yi-Zhuang You, Xiao-Liang Qi, Cenke Xu. *Entanglement holographic mapping of many-body localized system by spectrum bifurcation renormalization group*. Phys. Rev. B **93**, 104205 (2016).

[4] Yi-Zhuang You, Cenke Xu. *Interacting topological insulator and emergent grand unification theory*. Phys. Rev. B **91**, 125147 (2015).

[5] Yi-Zhuang You, Cenke Xu. *Symmetry-protected topological states of interacting fermions and bosons*. Phys. Rev. B **90**, 245120 (2014).

[6] Yi-Zhuang You, Xiao-Gang Wen. *Projective non-Abelian statistics of dislocation defects in a Z_N rotor model*. Phys. Rev. B **86**, 161107(R) (2012).

[7] Yi-Zhuang You, Itamar Kimchi, Ashvin Vishwanath. *Doping a spin-orbit Mott insulator: topological superconductivity from the Kitaev-Heisenberg model and possible applications to $(Na_2/Li_2)IrO_3$*. Phys. Rev. B **86**, 085145 (2012).

[8] Yi-Zhuang You, Fan Yang, Su-Peng Kou, Zheng-Yu Weng. *Phase diagram and a possible unified description of intercalated iron selenide superconductors*. Phys. Rev. Lett. **107**, 167001 (2011).

Book Chapters:

[9] Yi-Zhuang You, Zheng-Yu Weng. *Coexisting Itinerant and Localized Electrons*. In: *Iron-Based Superconductivity*, P. D. Johnson ed., Springer International Publishing, Springer Series in Material Science **211**, Chap. 10, p. 377-408 (2015).

Additional Articles:

[10] Nvsen Ma, Guang-Yu Sun, Yi-Zhuang You, Cenke Xu, Ashvin Vishwanath, Anders W Sandvik, Zi Yang Meng. *Dynamical signature of fractionalization at the deconfined quantum critical point*. Phys. Rev. B **98**(17), 174421 (2018).

[11] Xiaochuan Wu, Xiao Chen, Chao-Ming Jian, Yi-Zhuang You, Cenke Xu. *A candidate theory for the "strange metal" phase at finite energy window*. Phys. Rev. B **98**(16), 165117 (2018).

[12] Yi-Zhuang You, Yingfei Gu. *Entanglement features of random Hamiltonian dynamics*. Phys. Rev. B **98** (1), 014309 (2018).

[13] Meng Cheng, Zhen Bi, Yi-Zhuang You, Zheng-Cheng Gu. *Towards a complete classification of symmetry-protected phases for interacting fermions in two dimensions*. Phys. Rev. B **97** (20), 205109 (2018).

[14] Yi-Zhuang You, Yin-Chen He, Ashvin Vishwanath, Cenke Xu. *From bosonic topological transition to symmetric fermion mass generation*. Phys. Rev. B **97**(12), 125112 (2018).

[15] Yi-Zhuang You, Yin-Chen He, Cenke Xu, Ashvin Vishwanath. *Symmetric fermion mass generation as deconfined quantum criticality*. Phys. Rev. X **8**(1), 011026 (2018).

[16] Yan Qi Qin, Yuan-Yao He, Yi-Zhuang You, Zhong-Yi Lu, Arnab Sen, Anders W Sandvik, Cenke Xu, Zi Yang Meng. *Duality between the deconfined quantum-critical point and the bosonic topological transition*. Phys. Rev. X **7**(3), 031052 (2017).

[17] Xiao-Liang Qi, Zhao Yang, Yi-Zhuang You. *Holographic coherent states for random tensor networks*. JHEP 2017(8), 60 (2017).

[18] Zhen Bi, Chao-Ming Jian, Yi-Zhuang You, Kelly Ann Pawlak, Cenke Xu. *Instability of the non-Fermi-liquid state of the Sachdev-Ye-Kitaev model*. Phys. Rev. B **95**(20), 205105 (2017).

[19] Zheng Bi, Ruixing Zhang, Yi-Zhuang You, Andrea Young, Leon Balents, Chao-Xing Liu, Cenke Xu. *Bilayer graphene as a platform for bosonic symmetry protected topological states*. Phys. Rev. Lett. **118**, 126801 (2017).

[20] Kevin Slagle, Zhen Bi, Yi-Zhuang You, Cenke Xu. *Out-of-time-order correlation in marginal many-body localized systems*. Phys. Rev. B **95**(16). 165136 (2017).

[21] Yuan-Yao He, Han-Qing Wu, Yi-Zhuang You, Cenke Xu, Zi Yang Meng, Zhong-Yi Lu. *Quantum critical point of Dirac fermion mass generation without spontaneous symmetry breaking*. Phys. Rev. B **94**(24), 241111 (2016).

[22] Han-Qing Wu, Yuan-Yao He, Yi-Zhuang You, Tsuneya Yoshida, Norio Kawakami, Cenke Xu, Zi Yang Meng, Zhong-Yi Lu. *Visualizing a bosonic symmetry protected topological phase in an interacting fermion model*. Phys. Rev. B **94**, 165121 (2016).

[23] Zhen Bi, Yi-Zhuang You, Cenke Xu. *Exotic quantum critical point on the surface of three-dimensional topological insulator*. Phys. Rev. B **94**(2), 024433 (2016).

[24] Kevin Slagle, Yi-Zhuang You, Cenke Xu. *Disordered XYZ spin chain simulated using the spectral bifurcation renormalization group*. Phys. Rev. B **94**, 014205 (2016).
[25] Xue-Yang Song, Yi-Zhuang You, Leon Balents. *Low-energy spin dynamics of the honeycomb spin liquid beyond the Kitaev limit*. Phys. Rev. Lett. **117**, 037209 (2016).
[26] Zhen Bi, Yi-Zhuang You, Cenke Xu. *"Self-dual" quantum critical point on the surface of 3d topological insulator*. Phys. Rev. B **94**, 024433 (2016).
[27] Yizhi You, Yi-Zhuang You. *Geometric defects in bosonic symmetry protected topological phases*. Phys. Rev. B **93**, 245135 (2016).
[28] Yizhi You, Yi-Zhuang You. *Stripe melting and a transition between weak and strong symmetry protected topological phases*. Phys. Rev. B **93**, 195141 (2016).
[29] Yuan-Yao He, Han-Qing Wu, Yi-Zhuang You, Cenke Xu, Zi Yang Meng, Zhong-Yi Lu. *Bona fide interaction-driven topological phase transition in correlated SPT states*. Phys. Rev. B **93**, 115150 (2016).
[30] Yi-Zhuang You, Zhen Bi, Dan Mao, Cenke Xu. *Quantum phase transitions between bosonic symmetry-protected topological states without sign problem: Nonlinear sigma model with a topological term*. Phys. Rev. B **93**, 125101 (2016).
[31] Cenke Xu, Yi-Zhuang You. *Self-dual quantum electrodynamics as boundary state of the three dimensional bosonic topological insulator*. Phys. Rev. B **92**, 220416 (2015).
[32] Han-Qing Wu, Yuan-Yao He, Yi-Zhuang You, Cenke Xu, Zi Yang Meng, Zhong-Yi Lu. *Quantum Monte Carlo study of strange correlator in interacting topological insulators*. Phys. Rev. B **92**, 165123 (2015).
[33] Yi-Zhuang You, Cenke Xu. *Topological orders with global gauge anomalies*. Phys. Rev. B **92**, 054410 (2015).
[34] Kevin Slagle, Yi-Zhuang You, Cenke Xu. *Exotic quantum phase transitions of strongly interacting topological insulators*. Phys. Rev. B **91**, 115121 (2015).
[35] Yi-Zhuang You, Zhen Bi, Alex Rasmussen, Meng Cheng, Cenke Xu. *Bridging fermionic and bosonic short range entangled states*. New J. Phys. **17**, 075010 (2015).
[36] Cenke Xu, Yi-Zhuang You. *Bosonic short-range entangled states beyond group cohomology classification*. Phys. Rev. B **91**, 054406 (2015).
[37] Zhen Bi, Yi-Zhuang You, Cenke Xu. *Anyon and loop braiding statistics in field theories with topological Θ term*. Phys. Rev. B **90**, 081110(R) (2014).
[38] Yi-Zhuang You, Zhong Wang, Jeremy Oon, Cenke Xu. *Topological number and fermion Green's function of strongly interacting topological superconductors*. Phys. Rev. B **90**, 060502(R) (2014).
[39] P. Zhang, P. Richard, T. Qian, X. Shi, J. Ma, L.-K. Zeng, X.-P. Wang, E. Rienks, C.-L. Zhang, P. Dai, Y.-Z. You, Z.-Y. Weng, X.-X. Wu, J. P. Hu, H. Ding. *Observation of momentum-confined in-gap impurity state in $Ba_{0.6}K_{0.4}Fe_2As_2$: evidence for antiphase $s_{\pm}$ pairing*. Phys. Rev. X **4**, 301001 (2014).
[40] Yi-Zhuang You, Zhen Bi, Alex Rasmussen, Kevin Slagle, Cenke Xu. *Wave function and strange correlator of short range entangled states*. Phys. Rev. Lett. **112**, 247202 (2014).
[41] Yi-Zhuang You, Zheng-Yu Weng. *Two-fluid description for iron-based superconductors*. New J. Phys. **16**, 023001 (2014).

[42] Yi-Zhuang You, Chao-Ming Jian, Xiao-Gang Wen. *Synthetic topological degeneracy by anyon condensation*. Phys. Rev. B **87**, 045106 (2013).
[43] Yi-Zhuang You, Zhu Chen, Xiao-Qi Sun, Hui Zhai. *Superfluidity of bosons in Kagome lattice with frustration*. Phys. Rev. Letts. **109**, 265302 (2012).
[44] Xiaodong Zhou, Peng Cai, Aifeng Wang, Wei Ruan, Cun Ye, Xianhui Chen, Yizhuang You, Zheng-Yu Weng, Yayu Wang. *Evolution from unconventional spin density wave to superconductivity and a novel gap-like phase in* $NaFe_{1-x}Co_xAs$. Phys. Rev. Letts. **109**, 037002 (2012).
[45] Itamar Kimchi, Yi-Zhuang You. *Kitaev-Heisenberg-*J_2*-*J_3 *model for the iridates* A_2IrO_3. Phys. Rev. B **84**, 180407(R) (2011).
[46] Yi-Zhuang You, Hong Yao, Dung-Hai Lee. *The spin excitations of the block-antiferromagnetic state in* $K_{0.8}Fe_{1.6}Se_2$. Phys. Rev. B **84**, 020406(R) (2011).
[47] Yi-Zhuang You, Fan Yang, Su-Peng Kou, Zheng-Yu Weng. *Magnetic and superconducting instabilities in a hybrid model of itinerant/localized electrons for iron pnictides*. Phys. Rev. B **84**, 054527 (2011).
[48] Chen-Ning Yang, Yi-Zhuang You. *One-dimensional w-component fermions and bosons with repulsive delta function interaction*. Chinese Phys. Letts. **28**(2), 020503 (2010).
[49] Yi-Zhuang You. *Ground state energy of one dimensional δ-function interacting bose and Fermi gas*. Chinese Phys. Lett. **27**(8), 080305 (2010).
[50] Yizhuang You, Xiaohan Wang, Sihui Wang, Yonghua Pan, Jin Zhou. *A new method to demonstrate frustrated total internal reflection in the visible band*. Am. J. Phys. **76**(3), 224-228 (2008).

Preprints:

[51] Wei-Qiang Chen, Chao-Ming Jian, Liang Kong, Yi-Zhuang You, Hao Zheng. *A topological phase transition on the edge of the 2d* Z_2 *topological order*. arXiv:1903.12334 (2019).
[52] Rui-Zhen Huang, Da-Chuan Lu, Yi-Zhuang You, Zi Yang Meng, Tao Xiang. *Emergent Symmetry and Conserved Current at a One Dimensional Incarnation of Deconfined Quantum Critical Point*. arXiv:1904.00021 (2019).
[53] Ce Wang, Hui Zhai, Yi-Zhuang You. *Uncover the Black Box of Machine Learning Applied to Quantum Problem by an Introspective Learning Architecture*. arXiv:1901.11103 (2019).
[54] Nvsen Ma, Yi-Zhuang You, Zi Yang Meng. *Emmy Noether looks at the deconfined quantum critical point*. arXiv:1811.08823 (2018).
[55] Romain Vasseur, Andrew C Potter, Andreas WW Ludwig. *Entanglement transitions from holographic random tensor networks*. arXiv:1807.07082 (2018).
[56] Chao-Ming Jian, Zhen Bi, Yi-Zhuang You. *Lattice construction of duality with non-Abelian gauge fields in 2+1D*. arXiv:1806.04155 (2018).
[57] Yi-Zhuang You, Ashvin Vishwanath. *Superconductivity from valley fluctuations and approximate SO(4) symmetry in a weak coupling theory of twisted bilayer graphene*. arXiv:1805.06867 (2018).

[58] Zhihuang Luo, Yi-Zhuang You, Jun Li, Chao-Ming Jian, Dawei Lu, Cenke Xu, Bei Zeng, Raymond Laflamme. *Observing Fermion pair-instability of Sachdev-Ye-Kitaev model on a quantum spin simulator*. arXiv:1712.06458 (2017).

[59] Chao-Ming Jian, Alex Rasmussen, Yi-Zhuang You, Cenke Xu. *Emergent symmetry and tricritical points near the deconfined quantum critical point*. arXiv:1708.03050 (2017).

[60] Kevin Slagle, Zhen Bi, Yi-Zhuang You, Cenke Xu. *Many-body localization of symmetry protected topological states*. arXiv:1505.05147 (2015).

[61] Yi-Zhuang You, Meng Cheng. *Measuring modular matrices by shearing lattices*. arXiv:1502.03192 (2015).

[62] Yi-Zhuang You, Yoni BenTov, Cenke Xu. *Interacting topological superconductors and possible origin of 16n chiral fermions in the Standard Model*. arXiv: 1402.4151 (2014).

[63] Fangzhou Liu, Zhenghan Wang, Yi-Zhuang You, Xiao-Gang Wen. *Modular transformations and topological orders in two dimensions*. arXiv: 1303.0829 (2013).

Services

- Editorial Board Member for IOP Science journal "Machine Learning: Science and Technology" (MLST), (2019 - now).
- Referee for APS Journals (Phys. Rev. Lett., Phys. Rev. X, Phys. Rev. B), American Journal of Physics, and Chinese Physics Letters.
- Co-organizer of "The First International Conference on Machine Learning and Physics", Tsinghua University, Beijing, July 4-6 (2018).
- Co-organizer of "Artificial Intelligence and Quantum Physics workshop", Nanjing University, Nanjing, December 20-22 (2017).
- Co-organizer of "Topological States and Phase Transitions in Strongly Correlated Systems", Kavli Institute for Theoretical Science, Beijing, July 3-14 (2017).

Talks

Invited Talks:

- *Emergent symmetry and conserved currents at deconfined quantum critical points*. KIAS Workshop on Topology and Correlation in Quantum Materials. Korean Institute for Advanced Study, May 29 (2019).
- *Machine Learning Holography*. Machine Learning Meets Physics, Microsoft Research in Redmond, April 26 (2019).
- *Emergent symmetry and conserved currents at deconfined quantum critical points*. Topological Aspects of Condensed Matter, Harvard University (CMSA), April 1 (2019).
- *Machine learning physics: from quantum mechanics to holographic geometry*. APS March Meeting, Invited Talk, February 13 (2019).
- *Entanglement features of random Hamiltonian dynamics*. Conference on Novel Approaches to Quantum Dynamics, Kavli Institute for Theoretical Physics, August 30 (2018).
- *Valley fluctuations and SO(4) symmetry in twisted bilayer graphene*. Workshop on Electron Correlation and Superconductivity in Graphene and Related Materials: Moire is Different, Kavli Institute of Theoretical Science, Beijing, July 12 (2018).
- *Machine learning holography*. The First International Conference on Machine Learning and Physics, Tsinghua University, Beijing, July 6 (2018).

- *Deconfined criticality - from bosonic topological transitions to symmetric mass generation*. International Workshop on New Paradigms in Quantum Matter, Institute of Physics Chinese Academy of Science, Beijing, June 28 (2018).
- *Machine learning holography*. Workshop on Machine Learning in Geometry and Physics, Tsinghua Sanya International Math Center, Sanya, June 14 (2018).
- *From bosonic topological transition to symmetric mass generation*. Workshop on Field Theory Dualities and Strongly Correlated Matter, Aspen Center for Theoretical Physics, March 20 (2018).
- *Exotic quantum criticalities among 2+1D symmetry protected topological phases*. Workshop on Entanglement Universality in Correlated Electronic Systems, Southern University of Science and Technology of China, December 23 (2017).
- *Tensor network holography and deep learning*. Western Forum on Machine Learning and its Applications, Sichuan Normal University, December 13 (2017).
- *Symmetric mass generation in Dirac semimetals*. Workshop on Chaos, Duality, and Topology in Condensed matter Physics, University of Illinois at Urbana-Champaign, November 4 (2017).
- *Hyperbolic network, Boltzmann machine and holographic duality*. Frontiers in Artificial Intelligence and Application. Tsinghua University, July 22 (2017).
- *Machine learning and tensor network holography*. Workshop on Machine Learning and Many-Body Physics, Kavli Institute for Theoretical Science, June 30 (2017).
- *Bilayer graphene as a platform for bosonic symmetry protected topological states*. Many-body Entanglement and Topological Quantum Phenomena Workshop, Tsinghua Sanya International Mathematics Forum, December 13 (2016).
- *Exotic topological phase transitions in correlated spin-orbit coupled systems*. Program on New Phases and Emergent Phenomena in Correlated Materials with Strong Spin-Orbit Coupling, Kavli Institute for Theoretical Physics, September 3 (2015).
- *Exotic quantum phase transitions in strongly interacting topological insulators*. Asia Pacific Workshop, Zhejiang Univerisity, April 14 (2015).
- *Two-fluid model for Iron-based superconductors*. Beijing Forum on High-Temperature Superconductivity, Tengchong, May 30 (2013).

Seminar Talks:

- *Machine learning physics: from quantum mechanics to holographic geometry*. University of California Riverside, May 13 (2019).
- *Machine learning physics: from quantum mechanics to holographic geometry*. Harvard University, April 17 (2019).
- *Application of machine learning in quantum physics*. Philips (China) Investment Co. Ltd., Beijing, July 20 (2018).
- *Symmetry protected topological phases and phase transitions*. Tsinghua University, July 17-19 (2018).
- *From bosonic topological transitions to symmetric mass generation*. Sun Yat-Sen University, June 21 (2018).
- *Tensor network holography and deep learning*. Pennsylvania State University, April 9 (2018).
- *Dynamical signature of fractionalization at the deconfined quantum critical point*. Massachusetts Institute of Technology, March 27 (2018).
- *Tensor network holography and deep learning*. University of Massachusetts Amherst, February 27 (2018).

- *Tensor network holography and deep learning*. California Institute of Technology, November 27 (2017).
- *Tensor network holography and deep learning*. Perimeter Institute, November 21 (2017).
- *Bosonic symmetry protected topological states: theory, numerics, and experimental platform*. Yale University, May 18 (2017).
- *From symmetric mass generation to Sachdev-Ye-Kitaev model*. Brown University, May 10 (2017).
- *Bosonic symmetry protected topological states: theory, numerics, and experimental platform*. University of Maryland College Park, February 28 (2017).
- *Bosonic symmetry protected topological states: theory, numerics, and experimental platform*. University of Virginia, February 16 (2017).
- *Bosonic symmetry protected topological states: theory, numerics, and experimental platform*. University of California San Diego, January 25 (2017).
- *Sachdev-Ye-Kitaev model and thermalization on the boundary of many-body localized fermionic symmetry protected topological states*. Harvard University, November 1 (2016).
- *Entanglement holographic mapping of many-body localized system by spectrum bifurcation renormalization group*.Tsinghua University, September 21 (2016).
- *Entanglement holographic mapping of many-body localized system by spectrum bifurcation renormalization group*. University of California Berkeley, April 26 (2016).
- *Entanglement holographic mapping of many-body localized system by spectrum bifurcation renormalization group*. California State University Northridge, February 19 (2016).
- *Holographic mapping of many-body localized system by spectrum bifurcation renormalization group*. Perimeter Institute, December 4 (2015).
- *Fermion Green's function and strange correlator of strongly interacting topological superconductors*. Tsinghua University, June 26 (2014).