

# ZHENG ZHU

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## Working Experience:

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### Massachusetts Institute of Technology (MIT)

Cambridge, MA, USA

Postdoctoral Associate in Department of Physics (Nov. 2015-May 2018)

- Supervisor: Prof. Liang Fu
- Research Area: Topological states in condensed matters as well as their experimental realization

### Harvard University

Cambridge, MA, USA

Post-Doctoral Fellow in Department of Physics (Jun. 2018-Jul. 2020)

- Supervisor: Prof. Ashvin Vishwanath
- Research Area: Unconventional superconductivity and spin liquids in strongly correlated systems

## Education:

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### Tsinghua University

Beijing, China

Ph.D. in Institute for Advanced Study

2010-2015

- Supervisor: Prof. Zheng-Yu Weng
- Research Area: Numerical and theoretical study of high temperature superconductors
- Dissertation: Density matrix renormalization group study of lightly doped Mott insulators

### Nanjing University

Nanjing, China

Bachelor of Science in Physics

2006-2010

- Department for Intensive Instruction, Kuang YaMing Honors School

## Publications:

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- [1]. **Zheng Zhu**; D. N. Sheng; Ashvin Vishwanath, Doped Mott insulators in the triangular-lattice Hubbard model, **Phys. Rev. B** 105, 205110(2022).
- [2]. Shuai A. Chen, Qianqian Chen, **Zheng Zhu**, Proposal for asymmetric photoemission and tunneling spectroscopies in quantum simulators of the triangular-lattice Fermi-Hubbard model, **Phys. Rev. B** 106, 085138 (2022).
- [3]. Meng Zeng, **Zheng Zhu**, Juven Wang, Yi-Zhuang You, Symmetric Mass Generation in the 1+1 Dimensional Chiral Fermion 3-4-5-0 Model, **Phys. Rev. Lett.** 128, 185301(2022) (**Editors' Suggestion**).
- [4]. Qianqian Chen, Shuai A. Chen, **Zheng Zhu**, Weak Ergodicity Breaking in Non-Hermitian Many-body Systems, arXiv:2202.08638 (2022).
- [5]. **Zheng Zhu**, Qianqian Chen, Superconductivity in doped triangular Mott insulators: the roles of parent spin backgrounds and charge kinetic energy, arXiv:2210.06847 (2022).
- [6]. Si-yu Li, Zhengwen Wang, Yucheng Xue, Yingbo Wang, Shihao Zhang, Jianpeng Liu, **Zheng Zhu**, Kenji Watanabe, Takashi Taniguchi, Hong-jun Gao, Yuhang Jiang, Jinhai Mao, Imaging topological and correlated insulating states in twisted monolayer-bilayer graphene, **Nature Communications** 13,4225 (2022).
- [7]. Mingjie Zhang, Xuan Zhao, Kenji Watanabe, Takashi Taniguchi, **Zheng Zhu**, Fengcheng Wu, Yongqing Li, Yang Xu, Tuning Quantum Phase Transitions at Half Filling in 3L-MoTe<sub>2</sub>/WSe<sub>2</sub> Moiré Superlattices, **Phys. Rev. X** 12, 041015 (2022).
- [8]. Rong-Yang Sun, **Zheng Zhu**, Metal-insulator transition and intermediate phases in the kagome lattice Hubbard model, **Phys. Rev. B: Letter** 104, L121118 (2021).
- [9]. Ya-Hui Zhang and **Zheng Zhu**, Fractional Fermi liquid in a generalized t-J model, **Phys. Rev. B** 103, 115101 (2021).
- [10]. Shao-Kai Jian, **Zheng Zhu**, 2kF Density Wave Instability of Composite Fermi Liquid, **Phys. Rev. Research** 2, 033414 (2020).
- [11]. **Zheng Zhu**, D. N. Sheng, Inti Sodemann, Widely Tunable Quantum Phase Transition from Moore-Read to Composite Fermi Liquid in Bilayer Graphene, **Phys. Rev. Lett.** 124, 097604 (2020).
- [12]. Zheng Zhu, Zheng-Yu Weng, D. N. Sheng, Magnetic Field Induced Spin Liquids in S=1 Kitaev Honeycomb Model, **Phys. Rev. Research: Rapid Communications** 2, 022047 (2020).
- [13]. Rong-Yang Sun, **Zheng Zhu**, Zheng-Yu Weng, Complex Phase Diagram of Doped XXZ Ladder: Localization and Pairing, **Phys. Rev. Research** 2, 033007 (2020).
- [14]. **Zheng Zhu**, D. N. Sheng, Liang Fu, Spin/orbital density wave and Mott insulator in two-orbital Hubbard model on honeycomb lattice, **Phys. Rev. Lett.** 123, 087602 (2019).

- [15]. Rong-Yang Sun\*, **Zheng Zhu\***, Zheng-Yu Weng, Localization in a t-J type ladder with translational symmetry, **Phys. Rev. Lett.** 123, 016601(2019).
- [16]. **Zheng Zhu**, Shao-Kai Jian, D. N. Sheng, Exciton Condensation in Quantum Hall Bilayers at Total Filling  $\nu_T=5$ , **Phys. Rev. B: Rapid Communications** 99, 201108 (2019) (**Editors' suggestion**).
- [17]. Michał Papaj, **Zheng Zhu**, Liang Fu, Multichannel charge Kondo effect and non-Fermi liquid fixed points in conventional and topological superconductor islands, **Phys. Rev. B** 99, 014512 (2019).
- [18]. **Zheng Zhu**, Itamar Kimchi, D.N. Sheng, Liang Fu, Robust non-Abelian spin liquid and a possible intermediate phase in the antiferromagnetic Kitaev model with magnetic field, **Phys. Rev. B: Rapid Communications** 97, 241110 (2018).
- [19]. **Zheng Zhu**, D.N. Sheng, Zheng-Yu Weng, Pairing versus phase coherence of doped holes in distinct quantum spin backgrounds, **Phys. Rev. B** 97, 115144 (2018).
- [20]. **Zheng Zhu**, D.N. Sheng and Zheng-Yu Weng, Intrinsic translational symmetry breaking in a Mott insulator, **Phys. Rev. B** 98, 035129 (2018).
- [21]. **Zheng Zhu**, D.N. Sheng, Liang Fu, Inti Sodemann. Valley Stoner instability of the composite Fermi sea, **Phys. Rev. B** 98, 155104 (2018).
- [22]. Fabian Grusdt, **Zheng Zhu**, Tao Shi, Eugene Demler, Meson formation in the mixed-dimensional t-J model. **SciPost Phys.** 5, 057 (2018).
- [23]. Shuai Chen, **Zheng Zhu**, Zheng-Yu Weng, Two-hole ground state wavefunction: A non-BCS pairing in a t-J system, **Phys. Rev. B** 98, 245138 (2018).
- [24]. Wayne Zheng, **Zheng Zhu**, D. N. Sheng, Zheng-Yu Weng, Hidden spin current in doped Mott antiferromagnets, **Phys. Rev. B** 98, 165102 (2018).
- [25]. **Zheng Zhu**, Liang Fu, D.N. Sheng, Numerical Study of Quantum Hall Bilayers at Total Filling  $\nu_T=1$ : A New Phase at Intermediate Layer Distances. **Phys. Rev. Lett.** 119, 177601 (2017).
- [26]. Inti Sodemann, **Zheng Zhu**, and Liang Fu, Quantum Hall ferroelectrics and nematics in multivalley systems, **Phys. Rev. X** 7, 041068 (2017).
- [27]. **Zheng Zhu**, Inti Sodemann, D.N. Sheng, Liang Fu, Anisotropy Driven Transition from Moore-Read State to Quantum Hall Stripes, **Phys. Rev. B: Rapid Communications** 95, 201116 (2017).
- [28]. **Zheng Zhu**, Z. Y. Weng and Tin-Lun Ho, Spin and charge modulations in a single hole doped Hubbard ladder: verification with optical lattice experiments. **Phys. Rev. A** 93, 033614 (2016).
- [29]. **Zheng Zhu**, Qing-Rui Wang, D.N. Sheng and Zheng-Yu Weng, Exact sign structure of the t-J chain and the single hole ground state, **Nuclear Physics B**, 903, 51 (2016).
- [30]. **Zheng Zhu** and Zheng-Yu Weng, Quasiparticle collapsing in an anisotropic t-J ladder, **Phys. Rev. B** 92, 235156 (2016).
- [31]. **Zheng Zhu**, C. S. Tian, H. C. Jiang, Y. Qi, Jan Zaanen, and Z. Y. Weng, Charge modulation as fingerprints of phase-string triggered interference. **Phys. Rev. B** 92, 035113 (2015).
- [32]. **Zheng Zhu**, H. C. Jiang, D. N. Sheng and Z. Y. Weng, Nature of strong hole pairing in doped Mott antiferromagnets. *Scientific Reports*, 4, 5419 (2014).
- [33]. **Zheng Zhu**, H. C. Jiang, Y. Qi, C. S. Tian, and Z. Y. Weng, Strong correlation induced charge localization in Mott antiferromagnets, *Scientific Reports*, 3, 2586 (2013).

## Conferences/Visiting Experience:

- **Seminar talk at Harvard university** February,2018  
*(talk) The Stability of the Non-Abelian Topological Phase in the Kitaev Materials and Quantum Hall Systems*
- **Department of Physics, Princeton University** March,2017  
*Conference: The Quantum Hall Effect: Past, Present & Future*
- **2017 American Physical Society Annual Meeting, New Orleans, LA** March,2017  
*(talk) Anisotropy Driven Transition from Moore-Read State to Quantum Hall Stripes*
- **Condensed Matter Theory Seminars at MIT** May,2017  
*(talk) Numerical Study of Quantum Hall Systems with Half-filled Landau Levels: Anisotropy Effect on Moore-Read State & Phase Diagram of  $1/2+1/2$  Bilayers*
- **Seminar talk at Harvard** November,2017

*(talk) Density Matrix Renormalization Group Study of Lightly Doped Mott Antiferromagnets*

- **School of Physics and Astronomy, Shanghai Jiao Tong University** May, 2017  
*(invited talk) The phase diagram of Quantum Hall Bilayers*
- **Department of Physics, Cornell University** June, 2016  
*Conference: Emergent Phenomena in Quantum Materials*
- **Department of Physics, Stanford University** February, 2015  
*(invited talk) DMRG study of lightly doped Mott insulator*
- **Department of Physics, MIT** January, 2015  
*(invited talk) DMRG study of lightly doped Mott insulator*
- **Kavli Institute for Theoretical Physics, University of California, Santa Barbara (UCSB)**  
*Visiting Prof. Leon Balents's group* April, 2013 – May, 2014/ January, 2015- February, 2015
- **2014 American Physical Society Annual Meeting, Denver, Colorado ;** March, 2014  
*(talk) Hole binding in Mott antiferromagnets: A DMRG study*
- **Department of Physics and Astronomy, California State University, Northridge**  
*Visiting Prof. D.N. Sheng's group* January, 2014 – March, 2014/ March, 2013 – April, 2013
- **Aspen Winter Conference, Aspen, Colorado.** January, 2014  
*Conference: Beyond quasiparticles: New paradigms for quantum fluids*
- **2013 American Physical Society Annual Meeting, Baltimore, Maryland ;** March, 2013  
*(talk) Strong correlation induced charge localization in antiferromagnets.*
- **Beijing Forum on High temperature superconductivity (XiAn/LuoYang/ChengDu)** 2012-2015
- **Chinese Physics Society Fall Meeting (XiaMen/ChangChun)** 2013/2015

### Honors and Awards:

National Scholarship of China—Ph.D.	2014
National Scholarship of China—Undergraduate	2009
The First Prize of Scholarship in Tsinghua University	2013
The Second Prize of GuangHua Scholarship in Tsinghua University	2012
The First Prize of Bachelor's Degree Thesis in Nanjing University	2010
Outstanding Graduates Awards in Nanjing University	2010
De-xin Lu Awards of Kuang Yaming Honors School in Nanjing University	2010
Excellent Student in Nanjing University	2008
2008 National Scholarship for Encouragement of China	2008
2007 National Scholarship for Encouragement of China	2007