

**Kavli Institute Workshop on**

**Magnetism, Superconductivity, Topology (M-S-T)**

**Dates:** November 5-7, 2022

**Format:** Hybrid (both onsite & online)

**Onsite Location:** Songshan Lake Materials Laboratory, Dongguan, China

**Coordinators**

Prof. Jiangping Hu (Institute of Physics, Chinese Academy of Sciences)

Prof. Qian Niu (University of Science and Technology of China)

Prof. Fuchun Zhang (Kavli Institute for Theoretical Sciences, University of Chinese Academy of Sciences)

Prof. Zhenyu Zhang (Chair) (University of Science and Technology of China)

**Sponsor**

Kavli Institute for Theoretical Sciences, University of Chinese Academy of Sciences

**Co-sponsors**

Songshan Lake Materials Laboratory

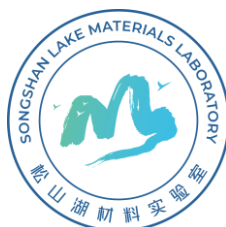
International Center for Quantum Design of Functional Materials, University of Science and Technology of China

**Administrative supports & Contacts**

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### **Mission of the Workshop**

The collective phenomena of magnetism and superconductivity constitute two of the enduring cornerstones of condensed matter physics, and each has further been shown to exhibit versatile robust behaviors encoded in its globally nontrivial topology. As extending posts on the imagination boundaries and conceptual challenges, the three, magnetism, superconductivity, and topology, burgeon to find coexisting harmony under proper physical conditions, and promise to deliver appealing technological incentives. This workshop is to invite a selected list of distinguished speakers from the broader international community to brainstorm on the latest developments and possible future directions of this vibrant area of interdisciplinary science. Each speaker is expected to not only showcase the latest excitements in his or her own research emphasis among the M-S-T, but also be geared to entangle with the other workshop theme(s). Besides the invited lectures, the workshop will arrange ample discussions and posters. The collective objective of the workshop is to critically assess the standing challenges and envision on likely future pathways.

The workshop is planned to have a hybrid format, physically taking place in Dongguan, but with the option to attend virtually. All the presentations with advance permission will be broadcasted live to benefit the broader scientific community.

### **Meeting Activities**

Keynote and invited talks (onsite & online) (all domestic speakers will present onsite)

Panel discussions

Poster sessions (displayed throughout the workshop for ample discussions)

### **List of Invitees in Alphabetical Order**

#### **Keynote Speakers**

Bogdan Andrei Bernevig (Princeton University, USA)

J. C. Séamus Davis (University of Oxford, UK)

Jiangping Hu (Institute of Physics, CAS, China)

Philip Kim (Harvard University, USA)

Kam Tuen Law (Hong Kong University of Science and Technology, Hong Kong SAR)

Hartmut Neven (Google, USA)

Yayu Wang (Tsinghua University, China)

Ruqian Wu (University of California, Irvine, USA)

#### **Invited Speakers**

Chunlei Gao (Fudan University)

Kui Jin (Institute of Physics, CAS)



Jianpeng Liu (Shanghaitech University)  
Haizhou Lu (Southern University of Science and Technology)  
Mingliang Tian (High Magnetic Field Laboratory, CAS)  
Xiangang Wan (Nanjing University)  
Jian Wang (Peking University)  
Zhi Wang (Sun Yat-sen University)  
Jinsheng Wen (Nanjing University)  
Congjun Wu (Westlake University)  
Fengcheng Wu (Wuhan University)  
Tao Wu (University of Science and Technology of China)  
Ke Xia (Southeast University)  
Yong Xu (Tsinghua University)  
Huiqiu Yuan (Zhejiang University)  
Changgan Zeng (University of Science and Technology of China)  
Tong Zhang (Fudan University)  
Yi Zhang (Peking University)  
Yuanbo Zhang (Fudan University)  
Hao Zheng (Shanghai Jiao Tong University)

**Discussion Leaders and Panelists**

Xianhui Chen (University of Science and Technology of China)  
Hong Ding (Shanghai Jiao Tong University)  
Zhong Fang (Institute of Physics, CAS)  
Donglai Feng (University of Science and Technology of China)  
Shiping Feng (Beijing Normal University)  
Xingao Gong (Fudan University)  
Jinfeng Jia (Shanghai Jiao Tong University)  
Jianxin Li (Nanjing University)  
Haiqing Lin (Zhejiang University)  
Yanming Ma (Jilin University)  
Tai Min (Xi'an Jiaotong University)  
Jian Shen (Fudan University)  
Bogen Wang (Nanjing University)  
Tao Xiang (Institute of Physics, CAS)  
Xincheng Xie (Peking University)  
Guangming Zhang (Tsinghua University)  
Zhongxian Zhao (Institute of Physics, CAS)  
Jianxin Zhong (Xiangtan University)



**Workshop Agenda**

Venue: 2F, Building C, Songshan Lake Materials Laboratory (SLAB)

(地点: 松山湖材料实验室 C 栋 2 楼报告厅)

<b>Day 1 -- November 5</b>	
8:30~8:50	<b>Welcome &amp; Opening Remarks</b> Chair: Prof. Zhenyu Zhang (USTC) Prof. Fuchun Zhang (Director, KITS, UCAS) Prof. Xincheng Xie (Associate Director, NSFC) Prof. Weihua Wang (Director, SLAB)
<b>Session I</b>	<b>Chair: Prof. Jian Shen (Fudan Univ)</b>
8:50~9:30	<b>Philip Kim (-12) (Harvard University, USA) (Keynote)</b> Correlated Electron States in Twisted Multilayer Graphene
9:30~10:00	<b>Yuanbo Zhang (Fudan University)</b> Quantum Anomalous Hall Effect in MnBi <sub>2</sub> Te <sub>4</sub>
10:00~10:30	<b>Photo Time &amp; Coffee Break</b>
<b>Session II</b>	<b>Chair: Prof. Tao Xiang (Institute of Physics, CAS)</b>
10:30~11:00	<b>Congjun Wu (Westlake University)</b> Frustrated Superfluidity and Superconductivity
11:00~11:30	<b>Tao Wu (University of Science and Technology of China)</b> Emergent Charge Order and Unconventional Superconductivity in Pressurized Kagome Superconductor CsV <sub>3</sub> Sb <sub>5</sub>
11:30~12:00	<b>Fengcheng Wu (Wuhan University)</b> Topological Phases in AB-Stacked MoTe <sub>2</sub> /WSe <sub>2</sub> : Z <sub>2</sub> Topological Insulators, Chern Insulators, and Topological Charge Density Waves
<b>Session III</b>	<b>Chair: Prof. Xianhui Chen (USTC)</b>
14:00~14:40	<b>Yayu Wang (Tsinghua University) (Keynote)</b> Doped Mott Insulator Perspective of High T <sub>c</sub> Cuprates
14:40~15:10	<b>Huiqiu Yuan (Zhejiang University)</b> Magnetic Quantum Criticality and Strange Metal Behavior
15:10~15:40	<b>Yi Zhang (Peking University)</b> Single-shot Quantum Measurements Sketch Topological Quantum Many-body States
15:40~16:00	<b>Coffee Break</b>
<b>Session IV</b>	<b>Chair: Prof. Donglai Feng (USTC)</b>
16:00~16:40	<b>Séamus Davis (-8) (University of Oxford, UK) (Keynote)</b>



	Exploring the Pair Density Wave State by Scanned Josephson Tunneling Microscopy
16:40~17:10	<b>Kui Jin (Institute of Physics, CAS)</b> Common Scaling of the Strange Metal Scattering in High- $T_c$ Superconductors
17:10~17:40	<b>Tong Zhang (Fudan University)</b> Observation of Robust Zero-energy State and Enhanced Gap in MnTe/Bi <sub>2</sub> Te <sub>3</sub> /Fe (Te, Se)
17:50~	<b>Banquet</b>

**Day 2 -- November 6**

<b>Session V</b>	<b>Chair: Prof. Zhong Fang (Institute of Physics, CAS)</b>
8:30~9:10	<b>Andrei Bernevig (-12) (Princeton University, USA) (Keynote)</b> Mapping of Twisted Bilayer and Trilayer Graphene to a Topological Heavy Fermion Problem
9:10~9:40	<b>Ke Xia (Southeast University)</b> Anomalous Hall Effect of Antiferromagnetic Mn <sub>3</sub> Ir
9:40~10:10	<b>Jianpeng Liu (ShanghaiTech University)</b> Interacting Dirac Fermions in Graphene-based Heterostructures
10:10~10:30	<b>Coffee Break</b>
<b>Session VI</b>	<b>Chair: Shiping Feng (Beijing Normal Univ)</b>
10:30~11:10	<b>Ruqian Wu (-15) (University of California, Irvine, USA) (Keynote)</b> Remote Control of Spin Polarization of Topological Corner States
11:10~11:40	<b>Haizhou Lu (Southern University of Science and Technology)</b> Topological and Disorder Corrections to the Transverse Wiedemann-Franz Law and Mott Relation in Kagome Magnets
11:40~12:10	<b>Jinsheng Wen (Nanjing University)</b> Dual Nature of the Magnetic Excitations and Kondo Effect in a van der Waals Ferromagnet Fe <sub>3-x</sub> GeTe <sub>2</sub>
<b>Session VII</b>	<b>Chair: Prof. Haiqing Lin (Zhejiang Univ)</b>
14:00~14:40	<b>Vic Kam Tuen Law (HKUST, Hong Kong SAR) (Keynote)</b> Interaction-driven Quantum Anomalous Hall States and Unconventional Josephson Junctions in Moiré Materials
D14:40~15:10	<b>Hao Zheng (Shanghai Jiao Tong University)</b> Manipulation of Superconducting State by Cooper Pair Momentum
15:10~15:40	<b>Jian Wang (Peking University)</b> Discrete Scale Invariance in Topological Materials



15:40~16:00	<b>Coffee Break</b>
<b>Session VIII</b>	<b>Chair: Prof. Jianxin Li (Nanjing Univ)</b>
16:00~16:30	<b>Xiangang Wan (Nanjing University)</b> Topological Materials from Symmetry
16:30~17:00	<b>Changgan Zeng (University of Science and Technology of China)</b> Inter-Layer Supercurrent Drag Effect
17:00~17:30	<b>Yong Xu (Tsinghua University)</b> Controllable Chirality and Band Gap of Quantum Anomalous Hall Insulators
17:30~18:30	<b>Panel Discussion on</b> <b>M-S-T: Standing Challenges &amp; Future Directions</b> Discussion Leaders: Prof. Qian Niu (USTC) Prof. Fuchun Zhang (UCAS)
18:40~	<b>Dinner Reception</b>

**Day 3 -- November 7**

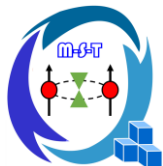
<b>Session IX</b>	<b>Chair: Prof. Xingao Gong (Fudan Univ)</b>
8:30~9:00	<b>Mingliang Tian (High Magnetic Field Laboratory, CAS)</b> Manipulating and Racing a Magnetic Skyrmion on the Spin Helix Highway
9:00~9:30	<b>Chunlei Gao (Fudan University)</b> Observation of Electronic Quasicrystalline-like Order at YbCl <sub>3</sub> /graphene Interface
9:30~10:00	<b>Zhi Wang (Sun Yat-sen University)</b> Berry Curvature Effects for Superconducting Quasiparticles
10:00~10:20	<b>Coffee Break</b>
<b>Session X</b>	<b>Chair: Prof. Fuchun Zhang (KITS, UCAS)</b>
10:20~11:00	<b>Hartmut Neven (-16) (Google, USA) (Keynote)</b> An Update from Google Quantum AI
11:00~11:40	<b>Jiangping Hu (Institute of Physics, CAS) (Keynote)</b> Topological Superconductivity in Iron-based Superconductors
11:40~12:00	<b>Concluding &amp; Outlooking</b> Prof. Zhongxian Zhao (Institute of Physics, CAS) Prof. Zhenyu Zhang (USTC)



**Poster Session**

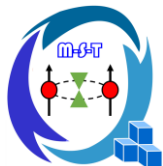
No.	Title	Authors	Organization
P1	Generic Rules for Achieving Higher Superconducting Transition Temperatures of Hydride Compounds at Lower Pressures	<u>Liangliang Liu</u> , Feng Peng, Peng Song, Xiaohan Liu, Liying Zhang, Xiaowei Huang, Chunyao Niu, Weifeng Zhang, Yu Jia, Zhenyu Zhang	Henan University
P2	Tailoring the Ordered Te Vacancy Lattices in Few-layer PtTe <sub>2-x</sub> for Enhancing Hydrogen Evolution	<u>Yaping Ma</u> , Xin Xu, Fangfei Ming, Xudong Xiao	Henan University
P3	Quasi Two-dimensional Superconductivity and Disorder-sensitive Vortex State in Intercalated Iron Selenide (Li,Fe)OHFeSe	<u>Dong Li</u> , Yue Liu, Zouyouwei Lu, Peiling Li, Zhaosheng Wang, Li Pi, Li Yu, Guangtong Liu, Jie Yuan, Kui Jin, Jens Hänisch, Fang Zhou, Xiaoli Dong, and Zhongxian Zhao	Institute of Physics, CAS
P4	Kondo Screening of Single Impurity Doped in a Superconductor with p-wave Pairing States	<u>Lin Li</u> , Jin-Hua Sun, Wei Su, Zhen-Hua Wang, Dong-Hui Xu, Hong-Gang Luo, and Wei-Qiang Chen	Sichuan Normal University
P5	Long-range Skin Josephson Supercurrent across a van der Waals Ferromagnet	Guojing Hu, <u>Changlong Wang</u> , Shasha Wang, Yan Feng, Bo Zheng, Bin Xiang, Qian Niu, Zhenyu Zhang	University of Science and Technology of China
P6	Computation and Data-driven Discovery of Topological Phononic Materials	<u>Jiangxu Li</u> , Jiayi Liu, Stanley A. Baronett, Dianzhong Li, Qiang Zhu, and Xing-Qiu Chen	Institute of Metal Research, Chinese Academy of Sciences
P7	Realization of Chiral Superstructure Ultraflat Bule Phosphorene	<u>Ye-Heng Song</u> , Yun-Hui Wang, Limei Wang, Limin She, Yu Jia, Ping Cui, Xue-Sen Wang, Weifeng Zhang, and Zhenyu Zhang	Henan University
P8	Optical Responses of Chiral Majorana Egde Modes	<u>James Jun He</u> , Yukio Tanaka, Naoto Nagaosa	University of Science and Technology of China
P9	A theory of Superconductor Diode Effect	<u>James Jun He</u> , Yukio Tanaka, Naoto Nagaosa	University of Science and Technology of China





P10	Tunable Dirac Semimetals with Higher-order Fermi Arcs in Kagome Lattices $\text{Pd}_3\text{Pb}_2\text{X}_2$ (X=S, Se)	Simin Nie, <u>Jia Chen</u> , Changming Yue, Congcong Le, Danwen Yuan, Zhijun Wang, Wei Zhang, and Hongming Weng	Zhejiang Lab
P11	Ferroelectric Tuning of Superconductivity and Band Topology in a Two-dimensional Heterobilayer	<u>Jianyong Chen</u> , Ping Cui, Zhenyu Zhang	Guilin University of Aerospace Technology
P12	Spin Properties of Co-phthalocyanine on Semi-metallic Bi(111) and Half-metallic $\text{CrO}_2$ (110) Surfaces	<u>Zhitao Shen</u> , Limin She, Yu Jia, Zhenyu Zhang	Henan University
P13	Magnetic Moment Preservation and Emergent Kondo Resonance of Co-phthalocyanine on Semimetallic Sb(111)	<u>Limin She</u> , Zhitao Shen, Zhenyang Xie, Limei Wang, Yeheng Song, Xue-sen Wang, Yu Jia, Zhenyu Zhang, Weifeng Zhang	Henan University
P14	Phase Boundary Resolving in Metallic Alloys by Lock-in Thermography	Jiachen Zhang, Takamasa HIRAI, Pukun Tan, Ryo Iguchi, Xianzhe Chen, Cheng Song, <u>Dazhi Hou</u> , K. Uchida	University of Science and Technology of China
P15	Chern Number Tunable Quantum Anomalous Hall Effect in Monolayer Transitional Metal Oxides via Manipulating Magnetization Orientation	<u>Zeyu Li</u> , Yulei Han, and Zhenhua Qiao	University of Science and Technology of China
P16	Structural, Electronic, Transport, Magnetic, and Spintronic Properties of Two-dimensional Insulating, Metallic, or Half-metallic Ferromagnets on $\text{NbSe}_2$	<u>Yutong Yang</u> , Tong Wei, Guohua Cao, Ping Cui, and Zhenyu Zhang	University of Science and Technology of China
P17	Electrene-enhanced Ferromagnetism by Design	<u>Guohua Cao</u> , Shunhong zhang, Yutong Yang, Jinrong Xu, Ping Cui*, and Zhenyu Zhang	University of Science and Technology of China
P18	Prediction of Monolayered $\text{CoX}$ (X = N, P, As, Sb, Bi) with Nontrivial Band Topology and Superconductivity	<u>Jiaqing Gao</u> , Wenjun Ding, Shunhong Zhang, Zhenyu Zhang, Ping Cui	University of Science and Technology of China
P19	Surprising Impact of Random Impurities on the Anomalous Hall Effect in Chiral Superconductors"	<u>Hao-Tian Liu</u> , Weipeng Chen, Wen Huang	Southern University of Science and Technology





P20	Superconductivity in Li-B-C System at 100 GPa	<u>Feng Zheng</u> , Yang Sun, Renhai Wang, Yimei Fang, Feng Zhang, Shunqing Wu, Cai-Zhuang Wang, Vladimir Antropov, Kai-Ming Ho	Xiamen University
P21	High-throughput Screening of Strong Electron-phonon Couplings in Ternary Metal Diborides	<u>Renhai Wang</u> , Yang Sun, Feng Zhang, Feng Zheng, Yimei Fang, Shunqing Wu, Huafeng Dong, Cai-Zhuang Wang, Vladimir Antropov, and Kai-Ming Ho	Guangdong University of Technology
P22	Van der Waals Heterostructure Pt <sub>2</sub> HgSe <sub>3</sub> /CrI <sub>3</sub> for Topological Valleytronics	<u>Zheng Liu</u> , Yulei Han, Yafei Ren, Qian Niu, and Zhenhua Qiao	University of Science and Technology of China
P23	Coexistence and Interplay of Pseudomagnetism and Antiferroelectricity in Few-layer Rippled Graphene	<u>Jinrong Xu</u> , Ping Cui and Zhenyu Zhang	1. University of Science and Technology of China 2. Anhui Jianzhu University
P24	BKT Phase Transition and Vortex Dynamics in a 2D Antiferromagnet	<u>Guokai Liao</u> , Shunhong Zhang, Cui Ping, Zhenyu Zhang	University of Science and Technology of China
P25	Correlation-enhanced Electron-Phonon Coupling for Accurate Evaluation of the Superconducting Transition Temperature in Bulk FeSe	<u>Wenjun Ding</u> , Yilin Wang, Tong Wei, Jiaqing Gao, Ping Cui*, and Zhenyu Zhang	University of Science and Technology of China
P26	Physical Origin of Current Partition at a Topological Trifurcation	<u>Sanyi You</u> , Tao Hou, Zhengtian Li, and Zhenhua Qiao	University of Science and Technology of China
P27	Ferroelectric Control of Spin Photovoltaic Effect	<u>Zhenyu Ding</u> , Wenguang Zhu	University of Science and Technology of China
P28	Thermoelectric Effects in Topological Insulators	<u>M. U. Muzaffar</u> , S. Zhang, Ping Cui, Zhenyu Zhang	University of Science and Technology of China
P29	Moriya Interaction and Topological Kerr effects in Two-Dimensional Magnets with Broken Inversion Symmetry	Xiaoyin Li, Caixing Liu, Ying Zhang, <u>Shunhong Zhang</u> , Huisheng Zhang, Tao Li, Chaoyang Kang, Fanyang Huang, Ruiguo Cao, Dazhi Hou, Ping Cui, Weifeng Zhang, Tai Min, Xiaohong Xu, Zhigao Sheng, Bin Xiang, Zhenyu Zhang	University of Science and Technology of China
P30	Weyl Physics in the Elemental Semiconductor Tellurium	<u>Lin Li</u> , Bin Cheng, Nan Zhang, Changgan Zeng	University of Science and Technology of China
P31	Unraveling Complex Magnetism in Two-dimensional FeS <sub>2</sub>	<u>Duo Wang</u> , Xin Chen, Biplab Sanyal	Macao Polytechnic University



P32	Enhanced Nematicity Emerging from Higher-order van Hove Singularities	<u>Xinloong Han</u> , Andreas P. Schnyder, and Xianxin Wu	Kavli Institute of Theoretical Sciences, UCAS
P33	Moiré Engineering of Nonsymmorphic Symmetries and Hourglass Superconductors	<u>Yifan Gao</u> , Ammon Fischer, Lennart Klebl, Martin Claassen, Angel Rubio, Li Huang, Dante M. Kennes	Southern University of Science and Technology
P34	Observation of Orbital Selective and Momentum Dependent Kink in Fe-based Superconductor $\text{CsCa}_2\text{Fe}_4\text{As}_4\text{F}_2$	<u>Peng Li</u> , Sen Liao, Zhicheng Wang, Zhengtai Liu, Dawei Shen, Shengtao Cui, Zhe Sun, Turgut Yilmaz, Elio Vescovo, Yilin Wang, Guanghan Cao, Juan Jiang, Donglai Feng	University of Science and Technology of China
P35	Phase Coexistence due to Inequivalent Nesting Vectors on Triangular Lattice	<u>Zhan Wang</u> , Fu-Chun Zhang	Kavli Institute of Theoretical Sciences, UCAS
P36	Topological Kerr Effects in Twodimensional Magnets with Broken Inversion Symmetry	<u>Ying Zhang</u> , Xiaoyin Li, Caixing Liu, Bin Xiang, Zhigao Sheng, Zhenyu Zhang	University of Science and Technology of China
P37	Two-stage Superconductivity in Hatsugai-Kohmoto-BCS Model	<u>Yu Li</u> , Vivek Mishra, Yi Zhou, Fu-chun Zhang	Kavli Institute of Theoretical Sciences, UCAS
P38	Signature of Quantum Interference Effect in Inter-layer Coulomb Drag in Graphene-based Electronic Double-layer Systems	<u>Lijun Zhu</u> , Xiaoqiang Liu, Lin Li, Xinyi Wan, Ran Tao, Zhongniu Xie, Ji Feng, Changgan Zeng	University of Science and Technology of China