

Shihao Ru

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WORK EXPERIENCE

Centre of Quantum Technologies, National University of Singapore	Singapore
Research Fellow	Aug 2023 – Mar 2025
National Centre for Advanced Integrated Photonics, Nanyang Technological University	Singapore
Research Fellow	Apr 2025 – Present

EDUCATION

Xi'an Jiaotong University	Xi'an, China
Ph.D. in Physics	Sep 2018 – June 2023
Thesis: Controlling Multi Degrees of Freedom of Photon and Preparing Quantum Light Source for Quantum Information Processing	
Xi'an Jiaotong University	Xi'an, China
B.Sc. in Applied Physics;	Aug 2014 – June 2018
Thesis: Theoretical Calculation of Nuclear Optical Clock Based on ^{229}Th	

RESEARCH INTERESTS

Quantum Network and Quantum Sensing Based on Spin Defect in Solid State, Spin Modulation and its Application in Quantum Many-Body Simulation, High-Speed Modulation of Multi Degrees of Freedom Light Field, Multi Photon Entanglement and Quantum Nonlocality, FPGA Development for Quantum Instrumentation.

PUBLICATIONS

- [1] Feifei Zhou, Peiyan Ma, Jiajun Li, Ke Jing, Shihao Ru, Hongwei Chen, Ying Dong, and Xinqing Wang. All-optical wide-field magnetometry with van der waals quantum sensor. *arXiv preprint arXiv:2606.07899*, 2026.
- [2] Yan Zhao, Yuhang Hou, Xiangbin Cai, Shihao Ru, Shunshun Yang, Yan Zhang, Xuran Dai, Qiuyu Shang, Abdullah Rasmita, Haiyang Pan, Kenji Watanabe, Takashi Taniguchi, Hongbin Cai, Hongyi Yu, and Weibo Gao. Electronic phonons in a moiré electron crystal. *arXiv preprint arXiv:2512.18217*, 2025.
- [3] Haotao Zhu, Zhenhua Li, Shuai Zhao, Xiaodan Lyu, Shihao Ru, Yizhi Huang, Zitong Xu, Rui Qu, and Weibo Gao. Experimental demonstration of scalable quantum cryptographic conferencing. *arXiv preprint arXiv:2512.06661*, 2025.
- [4] Qiuyu Shang, Kevin Dini, Hao Jiang, Nathan Wei En Seet, Xiangbin Cai, Shihao Ru, Xiufang Lu, Weng Chun Yu, Jiabin Zhao, Qihua Xiong, et al. On-chip photonic crystal dressed rydberg exciton polaritons with enhanced nonlinearity in monolayer ws_2 . *Nature Communications*, 16(1):10352, 2025.
- [5] Shihao Ru, Liheng An, Haidong Liang, Zhengzhi Jiang, Zhiwei Li, Xiaodan Lyu, Feifei Zhou, Hongbing Cai, Yuzhe Yang, Ruihua He, Robert Cernansky, Edwin Hang Tong Teo, Manas Mukherjee, Andrew A. Bettiol, Jesus Zúñiga-Perez, Fedor Jelezko, and Weibo Gao. Room-temperature electrical readout of spin defects in van der waals materials. *Phys. Rev. Lett.*, 135:220802, Nov 2025.
- [6] Liheng An, Haiyang Pan, Wen-Xuan Qiu, Naizhou Wang, Shihao Ru, Qinghai Tan, Xuran Dai, Xiangbin Cai, Qiuyu Shang, Xiufang Lu, Hao Jiang, Xiaodan Lyu, Shunshun Yang, Kenji Watanabe, Takashi Taniguchi, Fengcheng Wu, and Weibo Gao. Observation of ferromagnetic phase in second moiré band of twisted mote_2 . *Nature Comm.*, 16:5131, 2025.
- [7] Shihao Ru, Zhengzhi Jiang, Haidong Liang, Jonathan Kenny, Hongbing Cai, Xiaodan Lyu, Robert Cernansky, Feifei Zhou, Yuzhe Yang, Kenji Watanabe, Takashi Taniguchi, Fuli Li, Teck Seng Koh, Xiaogang Liu, Fedor Jelezko, Andrew A. Bettiol, and Weibo Gao. Robust nuclear spin polarization via ground-state level anticrossing of boron vacancy defects in hexagonal boron nitride. *Phys. Rev. Lett.*, 132:266801, Jun 2024.
- [8] Min An, Shihao Ru, Yunlong Wang, Yu Yang, Feiran Wang, Pei Zhang, and Fuli Li. Noisy quantum parameter estimation with indefinite causal order. *Phys. Rev. A*, 109:012603, Jan 2024.
- [9] Gang Qiang, Hongbing Cai, Abdullah Rasmita, Ruihua He, Lei Zhou, Shihao Ru, Xiangbin Cai, Xiaogang Liu, and Weibo Gao. Giant superbunching emission from mesoscopic perovskite emitter clusters. *Advanced Optical Materials*, 12(9):2302038, 2024.

- [10] Naizhou Wang, Daniel Kaplan, Zhaowei Zhang, Tobias Holder, Ning Cao, Aifeng Wang, Xiaoyuan Zhou, Feifei Zhou, Zhengzhi Jiang, Chusheng Zhang, Shihao Ru, Hongbing Cai, Kenji Watanabe, Takashi Taniguchi, Binghai Yan, and Weibo Gao. Quantum metric induced nonlinear anomalous hall effect and nonreciprocal longitudinal response in a topological antiferromagnet. *Nature*, 621(7979):487–492, 2023.
- [11] Feifei Zhou, Zhengzhi Jiang, Haidong Liang, Shihao Ru, Andrew A. Bettiol, and Weibo Gao. Dc magnetic field sensitivity optimization of spin defects in hexagonal boron nitride. *Nano Letters*, 23(13):6209–6215, 2023.
- [12] Hongbing Cai, Shihao Ru, Zhengzhi Jiang, John Jun Hong Eng, Ruihua He, Fu-li Li, Yansong Miao, Jesús Zúñiga-Pérez, and Weibo Gao. Spin defects in hbn assisted by metallic nanotrenches for quantum sensing. *Nano Letters*, 23(11):4991–4996, 2023.
- [13] Shihao Ru, Cen-Xiao Huang, Xiao-Min Hu, Chao Zhang, Feiran Wang, Ni Liu, Weidong Tang, Pei Zhang, Bi-Heng Liu, and Fuli Li. Experimental implementation of hardy-like quantum pigeonhole paradoxes. *Physical Review A*, 107(2):022207, 2023.
- [14] Zhengning Yang, Shihao Ru, Lianzhen Cao, Nikolay Zheludev, and Weibo Gao. Experimental demonstration of quantum overlapping tomography. *Physical Review Letters*, 130(5):050804, 2023.
- [15] Disheng Chen, Johannes E. Fröch, Shihao Ru, Hongbing Cai, Naizhou Wang, Giorgio Adamo, John Scott, Fuli Li, Nikolay Zheludev, Igor Aharonovich, and Weibo Gao. Quantum interference of resonance fluorescence from germanium-vacancy color centers in diamond. *Nano Letters*, 22(15):6306–6312, 2022.
- [16] Zhao Mu, Hongbing Cai, Disheng Chen, Jonathan Kenny, Zhengzhi Jiang, Shihao Ru, Xiaodan Lyu, Teck Seng Koh, Xiaogang Liu, Igor Aharonovich, and Weibo Gao. Excited-state optically detected magnetic resonance of spin defects in hexagonal boron nitride. *Physical Review Letters*, 128(21):216402, 2022.
- [17] Rui Qu, Yunlong Wang, Xiaolin Zhang, Shihao Ru, Feiran Wang, Hong Gao, Fuli Li, and Pei Zhang. Robust method for certifying genuine high-dimensional quantum steering with multimeasurement settings. *Optica*, 9(5):473, 2022.
- [18] Yu Yang, Shihao Ru, Min An, Yunlong Wang, Feiran Wang, Pei Zhang, and Fuli Li. Multiparameter simultaneous optimal estimation with an $SU(2)$ coding unitary evolution. *Physical Review A*, 105(2):022406, 2022.
- [19] Mengmeng Luo, Yuetao Chen, Jun Liu, Shihao Ru, and Shaoyan Gao. Enhancement of phase sensitivity by the additional resource in a mach-zehnder interferometer. *Physics Letters A*, 424:127823, 2022.
- [20] Shihao Ru, Weidong Tang, Yunlong Wang, Feiran Wang, Pei Zhang, and Fuli Li. Verification of kochen-specker-type quantum contextuality with a single photon. *Physical Review A*, 105(1):012428, 2022.
- [21] Yunlong Wang, Shihao Ru, Feiran Wang, Pei Zhang, and Fuli Li. Experimental demonstration of efficient high-dimensional quantum gates with orbital angular momentum. *Quantum Science and Technology*, 7(1):015016, 2021.
- [22] Feiran Wang, Shihao Ru, Yunlong Wang, Min An, Pei Zhang, and Fuli Li. Experimental demonstration of a quantum controlled-SWAP gate with multiple degrees of freedom of a single photon. *Quantum Science and Technology*, 6(3):035005, 2021.
- [23] Shihao Ru, Min An, Yu Yang, Rui Qu, Feiran Wang, Yunlong Wang, Pei Zhang, and Fuli Li. Quantum state transfer between two photons with polarization and orbital angular momentum via quantum teleportation technology. *Physical Review A*, 103(5):052404, 2021.
- [24] Shihao Ru, Yunlong Wang, Min An, Feiran Wang, Pei Zhang, and Fuli Li. Realization of a deterministic quantum toffoli gate with a single photon. *Physical Review A*, 103(2):022606, 2021.

RESEARCH ACTIVITIES

- Oral, The 4th National Academic Conference on Optical Quantum Science and Technology, 2025, Xi'an, China.
- Oral, The 19th National Conference on Quantum Optics, 2021, Nanchang and online, China.
- Best Poster Award, The 2nd National Academic Conference on Optical Quantum Science and Technology, 2021, Nanjing, China
- Best Oral Presentation Award, The 4th Optical Young Scientist Summit (OYSS), 2020, NingBo, China.

RESEARCH PROJECT

- Realizing and Controlling Coherently Nonlinear Interactions of Photons via Rydberg Polaritons, The General Program of National Natural Science Foundation of China 12074307 (Major Participants, Ranked Number 1)
- Quantum Characteristic of Many-Body Open Systems in Gravitational Background, The General Program of National Natural Science Foundation of China 12075178 (Major Participants, Ranked Number 1)

RESEARCH EXPERIENCE

- Hands-on experience in working with Spontaneous Parametric Down-Conversion (SPDC) systems for generating multi-photon entanglement.
- Familiar with programming and controlling various electrical and optical instruments, proficient in automation control.
- Proficient in operating ultra-low temperature equipment such as Bluefors and attoDRY, as well as characterizing and manipulating single-photon sources at low temperatures, including optical and microwave controls.

TECHNICAL SKILLS

Programming: Python, C, LABVIEW, $\text{\LaTeX}$; Scientific Computing Environment: MATLAB, OriginPro.

PROFESSIONAL SERVICE

Reviewer for *Physical Review Letters*, *Physical Review X*, *Physical Review A*, *Physical Review Research* and *Quantum Information Processing* journals.