

Shuqi Liu

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Educational Background

University of Science and Technology of China, B.S. in Physics 09/2021 - 07/2025 (expected)
Major: Atomic and Molecular Physics, GPA: 3.86/4.3, Rank: 23/138
Selected Courses: Quantum Mechanics 96, Atomic Physics 97, Optics 93, Computer Programming 91,
Fundamental of Electronics 95

Publications

Cai, Z., Chen, S., Deng, B., **Liu, S.**, Zhao, W., & Zhang, Z., *Diffraction patterns of optical discs under the far-field condition*, European Journal of Physics, 2023

Research Experience

Direct measurement of the spacial joint wavefunction of biphoton 12/2022 - Present

Advisor: Prof. Xiaoye Xu (Dept. of Optics and Optical Engineering, USTC)

Position: Undergraduate Researcher

Higher-dimensional degrees of freedom of photons can encode much more information than traditional qubits. However, measuring these states is quite challenging due to their large dimensionality. Based on the theory of weakvalue, this work proposed a solution to measure the joint wavefunction of biphoton directly.

- Proved that the joint wavefunction of biphoton can be determined by measuring the modular values of the momentum projection operator of the biphoton.
- Designed the experimental scheme for measuring the desired modular values. Utilized the polarization state of biphoton as the pointer, enabling the measurement of modular values in a single scan, significantly enhancing the efficiency of the measurement process.
- Programmed algorithm to simulate the evolution of the biphoton states based on the Hamiltonian describing the interaction between the observable and the pointer. The simulated results demonstrated the joint wavefunction of biphoton can be measured accurately for states in different spatial modes.
- Built a biphoton entanglement source based on BBO crystal. The photon pairs generated by the SPDC process are correlated in spatial wavefunction, which can be used for testing.
- Test the proposed solution based on the entanglement source and validate the theory (in progress).

Diffraction patterns of optical discs under the far-field condition 11/2022 - 02/2023

Advisor: Prof. Wei Zhao (Physics Experiment Teaching Center, USTC)

- Investigated the phenomenon of colored lines on CDs and DVDs under far-field illumination conditions. Developed a theoretical framework to estimate the color of the lines and calculated the coordinate expression for their locations.
- Participated in the design and construction of the experiment setup and measured the location and color of the colored lines under different angles of the observer or the light source. Utilized Gaussian process regression to analyze the experimental data, demonstrating a strong consistency with the theoretical predictions.

Skills

Software: Origin, Lumerical

Programming: Python, Matlab, Mathematica, C

Experiment: operation skills on optical platform (optimize nonlinear optical devices, photonic state tomography)

Knowledge: Quantum Information (Weak Measurement, Nonlocal Measurement, SPDC Process)

Atom-Light Interactions (NV-Diamond Magnetometer, CW and Pulse EPR)

English: TOEFL: 106 (Reading 29, Listening 29, Speaking 24, Writing 24), GRE: 330 (V 160, Q 170, AW 3.0)

Awards

- **First Prize in Seminar Project on Atomic Physics** (School of Physics, USTC, 5%) 06/2023
- **Excellent Student Scholarship (Silver)** This award recognizes students in the top 10% of their class in the annual comprehensive evaluation. (USTC, 10%) 12/2023
- **Excellent Student Scholarship (Silver)** This award recognizes students in the top 10% of their class in the annual comprehensive evaluation. (USTC, 10%) 12/2022
- **Endeavor Scholarship** This scholarship rewards students who have made excellent year-over-year progress in their studies. (USTC, 1%) 12/2022

Extracurricular

Science and Technology Week 05/2022

- Led the junior high school team to visit laboratories on campus and introduced the motivation and goal of the experiment to the visitors.
- Award: outstanding participation and successful completion of the assignment as an instructor in the Science and Technology Week held by USTC.

Science Fiction Publication 09/2020

- Published science fiction, the work was evaluated by many science fiction writers as unique and innovative, combining artistic tension and imagination, reported by People's Daily and other media.
- Publication: Liu, et al. Lights of the future[M]. Beijing, China: The Open University of China Publishing & Media Group, 2020.