Shijia Sun

☎ (+86) 13356345959 | ✉ sunshijia@berkeley.edu / shijia.sun@ustc.edu | 💻 https://shijia-sun.github.io/

RESEARCH INTERESTS

Trapped Ions Experiment; Atomic, Molecular and Optical Physics Experiment; Quantum Information and Quantum Computation; Quantum Simulation;

EDUCATION

University of California at Berkeley Remotely Enrolled

Accepted by Applied Science and Technology Ph.D. Program *Offer starting from Sept.2022*

- Deferred my courses several times due to visa problem, working in Lab remotely at the same time
- Got my U.S. visa after the U.S. Consulates processed security clearance for one year, but I was denied onboarding the plane to the U.S. in May 2023. Therefore, I had to withdraw my enrollment from UC Berkeley.

University of Science and Technology of China (USTC) Hefei, China

B.S. in Photoelectric Information Science and Engineering ***(Honorary Title)*** *Sept.2018-July.2022*

- GPA: **4.01**/4.3 (Ranking: **Top 3%** at School of Physical Sciences, USTC)
- Bachelor Thesis: Research of Ions' Dynamics in Paul-Optical Dipole Hybrid Trap, Supervisors: Prof. Dr. Jinming Cui
- Major Coursework: Modern Atomic Physics (**Graduate course**, 93), Introduction to Quantum Information (**Graduate course**, 97), Technique of Quantum Information (**Graduate course**, 94), Fundamentals of Modern Optics (**Graduate course**, 98), Quantum Mechanics (97), Atomic Physics (96),
- **Teaching Assistant Experience**: Atomic Physics (Prof. Minghui Liu) *Spring 2021*

PUBLICATIONS

- Cold hybrid electrical-optical ion trap. *arXiv pre-print*. Co-first author, the only student in the author list. *2023*

HONORS AND AWARDS

- Outstanding Graduate Title (**Top 5%** in USTC) *2022*
- China National Petroleum Corporation Scholarship (**Top 3%** in School of Physical Sciences, USTC) *2022*
- Jianghuai Weilai Scholarship (**Top 5%** in School of Physical Sciences, USTC) *2021*
- Hua Wei Scholarship (**Top 5%** in School of Physical Sciences, USTC) *2020*
- Gold Award, Outstanding Student Scholarship (**Top 5%** in School of Physical Sciences, USTC) *2019*
- Excellent Paper in Freshman Seminar (**Top 5%** in USTC) *2019*

RESEARCH EXPERIENCE

Key Laboratory of Quantum Information, Chinese Academy of Sciences Hefei, China

Undergraduate Research Assistant to Prof. Dr. Chuanfeng Li and Prof. Dr. Jinming Cui *Sept.2020-Present*

- **Learned basic AMO experiment skills** such as PCB assembly; Optical adjudgment; Laser control and alignment; Laser and fiber coupling adjustment, etc.
- **Cold Hybrid Electrical-optical Ion Trap,** co-first author, the only student in the author list
  - Proposed a hybrid ion trapping method by combining a Paul trap with optical tweezers, which combines the advances of the deep-potential feature for the Paul trap and the micromotion-free feature for the optical dipole trap.
  - Numerically and theoretically calculated the excess micromotion (eMM) energy of an ion in hybrid trap, which can reach the order of nK under 1 V/m stray field.
  - Proved that the ion eMM temperature can reach 100 nK level under relax experiment imperfections, i.e., even with a laser misalignment about 50 nm and 5% of RAF, under 1 V/m stray field.
  - Calculated magic wavelengths of different ion-atom pairs for ODTs in hybrid trap.
  - Simulated a three-dimensional cold collision process between a Yb^+ ion and a Rb atom, and found that the lifetime of the bound atom-ion pair produced in the hybrid trap is significantly prolonged to ~100 μs in average.

Ion Trap Group, Department of Physics, University of California at Berkeley Worked remotely
Engineering Graduate Student Researcher to Prof. Dr. Hartmut Haeffner *Sept.2022-Feb.2023*

• Interaction between the two-ion rotor and light carrying orbital angular momentum

- Calculated the Hamiltonian of interaction between a tilt Gaussian laser beam and the two-ion rotor. Proposed a form of Hamiltonian similar to that described by linear ion crystals, comparing rotational and vibrational states
- Calculated and simplified the Hamiltonian of interaction between a vertical LG beam and the two-ion rotor. Analyzed the quadrupole transition matrix elements with respect to the polarization of light and direction of B field. Proposed two experiment schemes to elaborate distinct feature of OAM beam interacting with ion rotor.

• Explore the influence of electrical noise on the ions' rotor

- Calculated the electric potential generated by surface electrodes by COMSOL and Python.
- Decomposed the AC noise near the ions' rotor to multipole expansions of electric field with different rotating speeds.
- Simulated evolution of angular momentum wavefunction when the quadrupole noise presented.

Ion Trap Group, Department of Physics, University of California at Berkeley Berkeley, CA, U.S.
Visiting Student Researcher to Prof. Dr. Hartmut Haeffner *July.2021-Nov.2021*

• Classical simulation of rotating ions' motion

- Calculated equilibrium position of any number of ions under RF field, quadrupole field and Coulomb repulsion, and the motion of ions in a spinning up quadrupole field at different temperatures.
- Determined the constraint stability of ions under different trap parameters.
- Optimized experimental parameters based on the calculated ions oscillation modes, frequency spectrum and width of rotational mode peak.

• Rotating ions angular momentum spectrum calculation and experiment control sequence modification

- Calculated angular momentum spectrum of rotating ions crystal classically at different temperatures.
- Simulated the evolution of angular momentum wave functions by QuTiP package with a rigid body model for three rotating ions to simplify the calculation.
- Lowered heating and noise near the trap via optimizing the control sequence and parameters of the circuit.

• Redesign, fabrication, assembly and test of circuit to rotate three ions

- Redesigned an 8-channel circuit and PCB by EAGLE to add and amplify signals from DAC and AWG accurately, and provided 58.6 V and 300 mA to each electrode on the ring ion trap.
- Fabricated the prototype board by milling machine and BantamTools software, selected appropriate electronic components, experimentally verified function and accuracy of rotating circuits.

Physics Experiment Teaching Center, USTC Hefei, China
Undergraduate Research Assistant to Prof. Dr. Zhongping Wang *Sept.2020-Dec.2020*

• Doped Si Quantum dots

- Prepared pure and B-doped Si nanocrystals by magnetron sputtering followed by high-temperature annealing.
- Measured the size of the Si nanocrystals of being ~20 nm in diameter using AFM.
- Measured Raman spectrum and photoluminescence spectrum. Observed, studied and explained the decrease in photoluminescence efficiency, and redshift, bimodal structure and broadening of the photoluminescence peak.

COMPETITIVE SKILLS & HOBBIES

• **Computer Skills**: Python (including QuTiP), SolidWorks, C, MATLAB, Mathematica, COMSOL simulation for Electric field, LaTeX, Eagle, Git, Lyx

• **Experiment Skills**: Circuits and PCB design by EAGLE, Laser control and adjustment, Digital/Analog electronics, Circuit prototype board fabrication by milling machine, Fluorescence Spectrometer, High Temperature Tube Furnace, Magnetron Sputtering Equipment, XRD

• **English Proficiency**:

- TOEFL: **101** (Reading 29, Listening 27, Speaking 20, Writing 25)
- TOEFL *MyBest*® Scores: 104 (Reading 29, Listening 27, Speaking 23, Writing 25)
- GRE General: Verbal 151, Quantitative 170 (**full score**), Analytical Writing 3.5

• **Hobbies:** Boxing, Taekwondo, Debate (member of debate team at USTC), Skiing, Swimming, Chinese Calligraphy