Pei-Dong Li

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Research Interests

Trapped-ion quantum information; surface-electrode ion traps; quantum control and readout of motional degrees of freedom in single ions; single-ion quantum thermodynamics and quantum heat engines; coherent spin–motion dynamics, laser cooling.

Education

Ph.D. in Physics, Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences (APM, CAS), Wuhan, China 2021–Winter 2026

- Ph.D. defence (expected): Winter 2026
- Division of Atomic, Molecular and Optical Physics
- Advisor: Prof. Mang Feng (Researcher, Group PI)
- Co-supervisor: Dr. Liang Chen (Associate Researcher)
- Research focus: Trapped-ion quantum thermodynamics and motional-state engineering

B.Sc. in Physics, Wuhan University, Wuhan, China 2017–2021

Research Experience

Single-ion phonon laser in the quantum regime 2023–present

- Lead experimentalist for single-ion phonon lasing, developing experimental scheme and realizing phonon-lasing states.
- Exploring applications for weak AC electric field sensing using phonon-lasing states.

Hybrid exceptional points in dissipative quantum systems 2025

- Led experimental implementation and data acquisition for a non-Hermitian system.
- Constructed hybrid exceptional points and observed second- and third-order eigenenergy splittings.
- Demonstrated enhanced response near higher-order exceptional points, relevant for quantum sensing.

Single-ion Quantum Szilárd Engine 2024

- Led experimental implementation on a surface-electrode ion trap and established motional-state control.
- Designed measurement protocols and performed motional-state reconstruction.
- Prepared figures and contributed to manuscript writing.

Quantum jump induced Liouvillian exceptional points 2024

- Led experimental setup, calibration, and execution on a trapped-ion platform.
- Assisted in selection of experimental parameters and performed data acquisition.
- Wrote the experimental section of the manuscript.

Single-spin Quantum Stirling Engine 2022

- Led experimental implementation and data acquisition.
- Assisted in experimental design and performed data analysis.

Single-ion experiments on a surface-electrode trap 2021–present

- Setup, optimized, and maintained the surface-electrode ion trap system.
- Performed micromotion compensation and sideband cooling to near motional ground state.
- Established coherent control of both internal (spin) and external (motional) degrees of freedom.

Technical Skills

Experimental: Surface-electrode ion trap operation, micromotion compensation, sideband cooling, coherent spin-motion control, Fock-state preparation and phonon-number reconstruction, experimental control and calibration.
Computational: Python, MATLAB, LabVIEW, SolidWorks, Altium Designer; numerical simulation and analysis of trapped-ion systems.

Awards & Honors

- Outstanding Student Leader, University of Chinese Academy of Sciences 2021–2022, 2022–2023
- Merit Student, University of Chinese Academy of Sciences 2023–2024, 2024–2025
- Third Prize, Wuhan City Science Popularization Contest 2024
- Excellence Award, Hubei Province Science Popularization Short Video Contest (Social Group) 2024
  "From Indivisible to Quantum Miracle: Journey of Atoms"

Publications

- **Pei-Dong Li***, Zhuo-Zhu Wu*, Kai-Feng Cui*, et al., "Experimental witness of phonon-transfer trajectories in a cyclic quantum Szilárd engine," Manuscript under review at *Science Advances* (2026).
- Zhuo-Zhu Wu*, **Pei-Dong Li***, Tai-Hao Cui, et al., "Experimental witness of quantum jump induced high-order Liouvillian exceptional points," *Nature Communications* **17**, 1923 (2026). DOI
- **Pei-Dong Li***, G.-Y. Ding*, J.-Q. Zhang, et al., "Experimental demonstration of single-spin Stirling engine cycles with enhanced efficiency," *Physical Review A* **111**, L010203 (2025). DOI

  **Co-first authors contributed equally.*

Referees

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