RUOPENG JIA

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Electrical Engineering | Integrated & Computational Photonics | Optical Sensing | Scientific Instrumentation

RESEARCH INTERESTS

- Integrated & computational photonics: coupled resonators, spectral engineering, inverse/data-driven design, integrated optical systems, and nonlinear/quantum photonic concepts.
- Photon-efficient imaging & sensing: photon counting, low-light measurement, phase/wavefront estimation, computational imaging, signal processing, and inference under limited or noisy data.
- Optical systems & scientific instrumentation: optical alignment and calibration, compact spectroscopy, electronic-photonic integration, system validation, and end-to-end measurement workflows.

EDUCATION

Northeastern University | Boston, MA **Sep 2022 - Apr 2024**

M.S. in Electrical and Computer Engineering

- Concentration: Electromagnetics, Plasma, and Optics | GPA: 3.88/4.00
- Thesis: Engineering Supermodes of Coupled Resonator Arrays | Advisor: Prof. Sunil Mittal
- Selected graduate preparation: Nanophotonics, Quantum Engineering, Electromagnetic Theory I/II, Database Systems, and Computer Engineering.

Northern Arizona University | Flagstaff, AZ **Sep 2017 - May 2022**

B.S. in Electrical Engineering

- Coursework and projects included signals and systems, microprocessors, semiconductor memories, electromagnetics, embedded control, power systems, computing tools, and astronomy.

SELECTED RESEARCH EXPERIENCE

CUORE Public-Data Project | Scientific Machine Learning & FPGA Inference **Ongoing**

Independent engineering research using public calorimeter waveforms

- Audited 10,000 public CUORE waveform windows, identifying 65 exact-overlap pairs, including 14 across the official train/test split; used group-aware evaluation to characterize dependence.
- Developed compact waveform classifiers, augmentation and morphology-based baselines to assess noise, registration shifts and fixed-point robustness.
- Deployed a 16-bit hls4ml MLP on Arty A7-100T: bit-exact C-simulation agreement on 1,350 validation events and 2.78 us model-core latency measured by on-board cycle counters.

Massachusetts Institute of Technology | Cambridge, MA **Jul 2024 - Jan 2025**

Research Collaborator, AMPLFI/LIGO | Advisor: Dr. Erik Katsavounidis

- Developed preprocessing, resampling, and parameter-constraint modules for Bilby/AMPLFI gravitational-wave parameter-estimation workflows, improving fitting efficiency by approximately 3x in benchmark tests.
- Evaluated trade-offs among computational cost, parameter constraints, low-signal inference, and model robustness using reproducible Python-based workflows.

Northeastern University, Quantum Photonics Lab | Boston, MA **May 2023 - Jun 2024**

Graduate Research Assistant | Advisor: Prof. Sunil Mittal

- Modeled supermode spectra of one- and two-dimensional coupled ring-resonator arrays using coupled-mode and numerical methods.
- Developed Fourier-domain perturbation and genetic-optimization methods; in a 40-ring open-boundary array, reduced the maximum unintended neighboring-mode shift from ~0.06 to ~0.02 while preserving the target spectral shift.
- Applied the framework to spectral engineering of four-wave-mixing quantum-light sources and compensation of fabrication-induced resonance disorder in simulation.

QuantumCTek Co., Ltd. | Jinan, China **May 2023 - Aug 2023**

Junior Research Associate, Quantum Communication | Advisor: Prof. Jian-Wei Pan

- Aligned and calibrated polarization-encoded quantum-communication links using photon counting and optical-link characterization.
- Conducted a 2 km outdoor link test, evaluating signal/background counts, optical alignment, environmental conditions, and end-to-end stability.
- Documented system configuration, test procedures, and component-selection decisions for field experiments.

ADDITIONAL RESEARCH EXPERIENCE

Northern Arizona University, Semiconductor and Device Research Lab | Flagstaff, AZ **Apr 2022 - Aug 2022**

Assistant Researcher | Advisor: Prof. Ying-Chen Chen

- Synthesized findings from 100+ papers on Ru- and WOx-based resistive-memory materials and analyzed cycling data from 500+ RRAM samples, focusing on endurance, switching behavior, and reliability.

California Institute of Technology, LIGO Data Analysis Project | Remote **Jun 2021 - Aug 2021**

Undergraduate Researcher | Advisor: Prof. Alan J. Weinstein

- Applied Fourier-domain filtering, waveform-template matching, and Bayesian ranking concepts to public LIGO data and documented candidate-signal analysis.

Princeton University, 21 cm Radio Astronomy Project | Remote **May 2021 - Aug 2021**

Undergraduate Researcher | Advisor: Prof. Daniel R. Marlow

- Processed Galactic 21 cm neutral-hydrogen spectra, derived line-of-sight velocities, and constructed a Milky Way rotation curve.
- Compared observed rotation behavior with luminous-matter expectations and dark-matter halo models; published the analysis in Journal of Physics: Conference Series.

SELECTED PUBLICATIONS

- Jia, R. “Engineering Supermodes of Coupled Resonator Arrays.” M.S. thesis, Northeastern University, 2024.
- Jia, R. “Research on the Galaxy Rotation Model based on 21 cm Hydrogen Spectrum.” Journal of Physics: Conference Series 2287 (2022): 012038. doi:10.1088/1742-6596/2287/1/012038.

HONORS & AWARDS

Dean's List, Northern Arizona University, Flagstaff, AZ (May 2022)

PROFESSIONAL & SYSTEMS EXPERIENCE

Long Voyage, Inc. | Passenger transportation & travel services **Mar 2026 - Present**

Co-founder | Sales, Operations & Systems

- Co-founded an East Coast passenger-transportation and travel-services business providing private charters, shared intercity rides, and custom trip support; handled customer-facing sales and service planning.
- Designed and tested operating workflows for trip requests, pricing, route/time confirmation, vehicle and driver coordination, customer communication, and exception handling under live service conditions.
- Used customer inquiries, trip-level exceptions, and recurring manual bottlenecks to refine service rules, internal tracking, and requirements for automation and information systems.

IntelliOpus Engineering, Inc. | Smart-office & height-adjustable desk systems **Jul 2024 - Present**

Technical Specialist | Sales, System Setup & Validation

- Supported U.S.-market sales and technical support for height-adjustable desk components and intelligent lifting-control systems, combining customer requirements with hands-on product setup and functional testing.
- Assembled and configured demonstration and test setups, reproduced installation or control issues, and documented repeatable test cases to distinguish configuration problems from product or system faults.
- Used recurring customer questions and field feedback to clarify technical requirements, identify product-fit constraints, and prioritize follow- up testing or system improvements.

SELECTED TECHNICAL PROJECTS

UnionGPT | AI-assisted historical-research workflow system **Aug 2024 - Present**

Creator & Developer | Collaboration: Research Team, School of History, Nankai University

- Created UnionGPT in collaboration with a research team in the School of History at Nankai University to support archival research in the history of medicine and science, including work on Peking Union Medical College and the Rockefeller Foundation.
- Designed workflows for organizing archival notes and source metadata across the Rockefeller Archive Center, Library of Congress, and U.S. National Archives, structuring entities, dates, box/folder references, and research themes for retrieval and cross-checking.
- Built evaluation cases for source retrieval, traceability, and long-form research tasks; documented failure modes and regressions and iteratively refined prompts, knowledge organization, and task templates to improve consistency and reduce repeated manual work.

Northern Arizona University, Capstone Design | Flagstaff, AZ **Sep 2021 - May 2022**

Team Lead, Remote-Controlled Research Greenhouse | Advisor: Prof. Robert Severinghaus

- Led the design of an Arduino- and Dataforth-based environmental-control system for temperature, soil-moisture, and illumination monitoring.
- Implemented a PostgreSQL-backed server for remote monitoring and control and coordinated system integration, testing, and project scheduling.

TEACHING & TECHNICAL COMMUNICATION

Independent Instruction | Remote / Boston, MA **2025 - Present**

Instructor/Tutor | Mathematics & Engineering

- Designed and delivered structured instruction in university-level mathematics and engineering, including differential equations, vector calculus, signals and systems, and related problem-solving methods.
- Prepared review plans, worked examples, and targeted problem sets based on student progress and examination requirements.

Northeastern University | Boston, MA **Sep 2022 - Apr 2024**

Teaching Assistant

- Supported Electrical Engineering Laboratory and Fundamentals of Electromagnetics through problem solving, laboratory troubleshooting, and technical reporting.

TECHNICAL SKILLS

Optics & Photonics: Ring-resonator arrays; coupled-mode theory; supermode and spectral engineering; Fourier-domain/inverse design; nonlinear/quantum-light-source concepts; QKD; photon counting; optical alignment; low-light link characterization.

Scientific Computing & Inference: Python; MATLAB; NumPy; SciPy; Pandas; JAX; Bilby; PyTorch; TensorFlow; scikit-learn; Bayesian inference; optimization; waveform modeling; signal processing; spectral analysis; data resampling.

Systems, Testing & AI: Product/system setup; functional validation; issue reproduction; test-case documentation; requirement translation; workflow design; iterative system improvement; AI-assisted research workflows; source traceability; retrieval evaluation; UnionGPT regression testing.

Hardware-Aware ML & FPGA: Quantization; fixed-point validation; hls4ml; Vitis HLS / Vivado; Arty A7 hardware verification; noise and timing-shift robustness.