

Jacky Song

Computational physicist & developer | Founder of Project Elara

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Education

2023 - 2026 **B.S. in Applied Physics, Rensselaer Polytechnic Institute**

Graduated *cum laude* with a degree in Applied Physics from Rensselaer and a concentration in computational quantum physics.

Research

2021 - Present **Ultra-long-distance power transmission and space-based energy capture**

Lead researcher of the [Project Elara](#) team; conducted research into modeling electromagnetic power transmission for space-based power transmission and designing high-power free-electron lasers using Monte-Carlo simulations.

2021 **Investigation and optimization of spacetime metrics for interstellar travel**

Performed numerical analysis of a spacetime metric in General Relativity (GR) with known applications in interstellar travel as part of an independent research project. Created a custom dataset and neural network for predicting the T^{00} element of the stress-energy tensor.

2025 **Machine learning-assisted material prediction and simulation for laser active media**

Utilized machine learning on the [AiMOS supercomputer](#) to be able to predict materials optimally-suited for laser gain media for building next-generation lasers. Research conducted as part of the [Materials Intelligence research group](#) with collaborators at UCLA.

Publications

- ***Development of a novel open-source space-based solar power system (in-progress)***
Culminating paper for multi-year research into the development of a complete open-source system for space-based solar energy, the first open-source system of its kind in the world.
- ***The Elara Handbook (in-progress)***
Open access textbook dedicated to providing a complete undergraduate and essential graduate education in physics, mathematics, and engineering.¹
- ***A Learner's Guide to Advanced Theoretical Physics (in-progress)***
Open access undergraduate-level book series on quantum field theory, general relativity, and other topics in theoretical physics (web-based).²

Relevant experience

Computational research Created custom numerical libraries³ for numerical integration, automatic differentiation, machine learning, and symbolic computation in Rust and Python. Implemented novel symbolic-to-numerical pipeline for streamlining engineering and physics computations in solving differential equations, as well as visual frontend.

Computer graphics Created custom open-source library⁴ for OpenGL-based rendering with signed distance fields (SDFs). Incorporated implementations for scientific visualization and 2D rendering, including astrophysical real-time raytracing and high-quality UI rendering.

¹Available online at <https://handbook.elaraproject.org/>.

²Available online at <https://learnthetheoreticalphysics.com/>.

³See <https://crates.io/crates/elara-math-community> and <https://codeberg.org/elaraproject/elara-symbolic>

⁴See <https://codeberg.org/elaraproject/elara-gfx-community>

Graphics (continued)	5+ years of experience in 3D software (Blender), video compositing, and video editing. Active contributor to open-source VFX compositing tool Natron . Created open-source site for icon distribution among graphics applications. Designer of numerous websites. Extensive graphic design experience (logos, posters, presentations).
Scientific education	Author of multiple textbooks on STEM topics. Creator of 800+ pages of open-source guides intended to cover a complete undergraduate degree in physics. Strong advocate of open science and public access to scientific knowledge.
STEM outreach	Participated in multiple public engagement events as part of SPS (Society of Physics Students), demonstrating physical principles with public experiments. Gave workshop at the public-education initiative Coding&&Community to foster interest in STEM for middle- and high-school students.
Experimental physics	Conducted experiments for testing muon decay, optical pumping, and Larmor precession at the Advanced Undergraduate Physics Laboratory at RPI. Performed data analysis with Python and numerical packages.
Open-source	5+ years of experience with open-source development. Creator of 50+ open-source repositories, ranging from command-line utilities to scientific and engineering software. Contributor to multiple open-source projects.

Academic positions

Head of Project Elara	Founder and Head of Project Elara , a nonprofit open-source organization dedicated to advancing space-based solar power research.
Research lead	Head of a multidisciplinary research group conducting computational modelling, prototyping, and testing of novel lasers, satellites, and wireless power receivers for space-to-earth power transmission.
RCOS coordinator	Coordinator and student leader at the Rensselaer Center for Open-Source (RCOS) and acted as a Teaching Assistant for the CSCI-1700, CSCI-2700, CSCI-4700 and CSCI-4710 courses.

Associations and affiliations

Society of Physics Students (SPS)	Member of SPS at Rensselaer Polytechnic
Rensselaer Polytechnic Institute	Alumnus and continuing volunteer
Rensselaer Center for Open-Source (RCOS)	RCOS coordinator (TA)

Skills

Specializations	Computational physics, electromagnetics, quantum physics, mathematical modelling, numerical simulations, open-source development, scientific education & outreach
Programming languages	C, Python, Rust, GLSL, MATLAB/Octave, Mathematica, HTML, CSS, Sass, JavaScript, Typescript, LaTeX, Typst
Technologies	NumPy/SciPy/Pandas, Jupyter, CMake, OpenGL, Jekyll, Zola, Flask, NodeJS/NPM, Tailwind, Linux, Bash, SSH, Git, Numba, TensorFlow/Keras, Scikit-learn, Optuna, Streamlit
Technical skills	Finite difference & finite element simulations, high-performance computing, graphics rendering, machine learning, full-stack web development
Software	MATLAB, Mathematica, FreeFEM, Figma, Blender, Inkscape, DaVinci Resolve, OpenSCAD
Creative skills	Video editing, 3D modelling & graphics, 2D vector graphics, instrumental performance, music composition, UI/UX design, web design, logo design, graphic design, scientific and technical writing.
Languages	Advanced fluency in English. Proficient in Chinese (listening, speaking, digital writing).