

## Oscar Rue Scholin

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<https://pypi.org/project/oscars-toolbox/>

### EDUCATION

**Cambridge University**, Hughes Hall, Cambridge, UK

Masters of Philosophy in Physics, Advisor: Dorian Gangloff

Expected October 2025

**Pomona College**, Claremont, USA

Bachelor of Arts, Physics and Math; Cumulative GPA: 3.889

May 2024

### HIGHLIGHT OF CLASSES

Abstract Algebra, Advanced Linear Algebra, Mathematics of Big Data and Machine Learning, Partial Differential Equations, Dynamical Systems and Chaos Theory, General Relativity, Particle Physics, 3 Semesters of Quantum Mechanics, 2 Semesters of Advanced Experimental Physics Lab, Advanced Introduction to Astronomy, Observational Astrophysics Lab

For detailed summary of all math and physics courses I have taken, see

<https://docs.google.com/document/d/1Ha6jjJrNpMellkx9bmwZQCWWYPESVrsKt0hVd5mUfoA/edit>

### TECHNICAL SKILLS

- Physics research
  - 2 continuous years research in theoretical (analytical and computational) and experimental quantum mechanics (optics) focusing on entanglement
  - 2 years of machine learning research (supervised, unsupervised, a bit of RL) focusing on physics-based problems as well as the development of new algorithms (SGD, quantum, differential geometry), including managing a team of over 10 members for a year
- Scientific computing and data analysis
  - Python (including but not limited to: machine learning (Tensorflow/Keras/Pytorch), quantum algorithms (Qiskit, PennyLane, QuTip), scientific computing and symbolic computation (SciPy, Scikit-Learn, SymPy, Numpy, Pandas, Matplotlib, Multiprocessing, Astropy, just-in-time compilation (Numba)); Matlab; LaTeX
- Web development
  - HTML, CSS, Amazon EC2

## SCIENTIFIC PUBLICATIONS

- Scholin, O. and Lynn, T.W. 2024. In prep for submission to *Physical Review Letters*.
  - Title: General Complete Symmetrized Qudit Bell Bases
  - Highlight: I developed a complete basis of bipartite fully entangled mutually orthogonal states with single particle dimension  $d$  and applied this basis to generalize previous logic for using an LELM device with single shot measurement to distinguish the maximum number of these states for an even dimension.

## RESEARCH EXPERIENCE

### MPhil Student, Quantum Engineering Group, Cavendish Lab Cambridge University

Advisor: Professor Dorian Gangloff, St. John's College

- Fall 2024-Fall 2025 research-based Masters of Philosophy Program to develop a mapping to simulate a central spin system, e.g. quantum dot, on a neutral atom quantum computer by the company Quera.
- Building, optimizing, and documenting resources for classical simulations of the central spin system.

### Research Assistant, Engineering and Light Groups, Imperial College

PIs: Drs. Henry Lee and Shang Yu

- Summer 2024-present remote work investigating the electron transport properties of hyaluronic acid.
- Designing an algorithm to use Imperial's Gaussian Boson Sampling (GBS) device efficiently perform the simulation in the beyond-classical limit

### Machine Learning Intern, Machine Learning Engineer, Dasion

Advisor: Professor (Harvey Mudd College) and CEO (Dasion) Weiqing Gu

- Spring-Summer 2024 (intern in Spring, full-time paid engineer Summer, part-time engineer after starting my MPhil)
- Developing differential-geometric inspired algorithms for interpretable classification of MNIST digits in addition to EEG and other medical data using manifold analysis for the company Dasion (<https://data-to-decision.com/>). Collaborating with a leading oceanographic institute, Monterey Bay Aquarium Research Institute (MBARI), to implement my algorithm for in situ real time detection on a long range autonomous underwater vehicle (LRAUV).
- Assisted CEO with NSF grant application process

### Harvey Mudd College, Physics Department

Advisor: Professor Jason Gallicchio

- Independent research study, Spring 2024, on the theoretical and experimental implementation of quantum computing with 4 other Pomona College students

- Literature review of linear optical conditional gates in photonic systems, photonic chips, Gaussian Boson Sampling, superconducting qubits, trapped ion qubits, topological qubits, and free electron qubits

### **Senior Thesis, Harvey Mudd College and Pomona College, Physics Department**

Advisor: Professor Theresa Lynn

- Thesis work, Fall 2023-Spring 2024 on distinguishing hyperentangled Bell states using linear evolution and local measurement (LELM) devices, when the dimension of single particles is 6.
- Individually developed and proved an exact expression for a symmetric basis with respect to particle exchange for any even-dimension fully entangled particles. Manuscript in progress. For more information, see [https://docs.google.com/document/d/1WsG\\_AMu1Mr\\_tukw9HZ7bq-SQqRuWX7BEq7pw5\\_lsLh0/](https://docs.google.com/document/d/1WsG_AMu1Mr_tukw9HZ7bq-SQqRuWX7BEq7pw5_lsLh0/)

### **Senior Thesis, Pomona College, Mathematics Department**

Advisor: Professor Ami Radunskaya

- Thesis work, Fall 2023-Spring 2024 on building a simulation environment for wormhole teleportation with SYK Hamiltonians using Qiskit
- Simulated and took real data from IBM Eagle processor; built and trained custom machine learning algorithms for compression.

### **Research Assistant, Harvey Mudd College, Physics Department**

Advisor: Professor Theresa Lynn

- Independent research study, Summer 2023, on entanglement witnesses and random 2-qubit generation.
- Designed and implemented machine learning algorithms to optimize the process of verifying entanglement given inputs of certain projective probabilities, for an increase of over 4% on previous models and a strong indication of saturation of input correlations.
- Produced selected states in the laboratory to test theoretical results from custom variational quantum eigensolver state learner with up to 99.3% fidelity.
- Presented work, "Entanglement Witnessing: a Neural Network Optimization and Experimental Realization", at SQuInT (Southwest Quantum Information and Technology) 2023 conference.

### **Research Assistant, Harvey Mudd College, Physics Department**

Advisor: Professor Theresa Lynn

- Independent research study, Spring 2023, on distinguishing hyperentangled Bell states using linear evolution and local measurement (LELM) devices (foundations for my senior thesis)
- Surveyed literature, performed analytical and numerical work in Python.

### **Research Assistant, Pomona College, Physics Department**

Advisors: Elijah Quetin (summer), Professor Phillip Choi (fall)

- Independent research study, Summer 2022, on the detection of Tidal Disruption Events (TDEs) in the Hubble Catalog of Variables (HCV).
- A lgorithm yielded two potential candidates being followed up.
- Self-studied supervised neural networks and unsupervised machine learning algorithms.
- Developed a >85% accuracy supervised neural network on unseen lightcurve data from the ASAS-SN dataset during Fall 2022.

### **Research Assistant, Pomona College, Classics Department**

Advisor: Professor Benjamin Keim

- Remote independent research study, Summer 2021, on the Justinianic plague pandemic (542 CE).
- Incorporated over 330 sources, from primary accounts to modern scholarly commentary to cutting-edge epidemiological and genomic research, to write a 130 page paper.
- Argued for the consideration of plague as a multifaceted biological, psychological, social, cultural, and artistic phenomenon as well as against the currently accepted narrative of the Justinianic plague as complete “catastrophe.”

## **EXTRACURRICULAR RESEARCH**

### **5-C P-AI (Claremont Colleges Artificial Intelligence) Club**

Unsupervised Clustering for Variable Stars

- Project founder of a 12-person team, August 2023–May 2024.
- Builds on my research from Summer 2022 and intends to create unsupervised machine learning models capable of distinguishing variable stars and their subtypes.
- Ultimate goal is to analyze contact binary systems, an active area of research in the astronomy community.

Prediction of Album Scores

- Technical lead, September 2022–December 2022
- Created data processing pipeline, designed and implemented a convolutional neural network to predict the ratings of music albums based on converting songs into spectrograms.

### **Chapter for a Book on AI and Math**

- Project with faculty member Gizem Karaali and former math student Kamden Baer Summer 2023–Winter 2023
- Wrote a roughly 10,000 word chapter for the book *Interdisciplinary Perspectives in Math and Cognition*, focusing specifically on how LLM models solve logic-based problems and comparing them to humans’ attempts.

### **Thinking Parrot**

- In the class Medieval Proof with Professor Jordan Kirk over Fall 2022, coded and implemented three distinct iterations of a large language generative literature recurrent neural network I have named Thinking Parrot.

- Wrote > 100 pages worth of essays describing how Thinking Parrot functions, interpreting and literarily analyzing its output, and reflecting on the ethical implications.

## **AWARDS**

### **Wig Scholarship (Fall 2022)**

- Grant from the Pomona English department to build a deep learning machine to train my literature generating deep recurrent neural network.

### **Pomona College Scholar (Fall 2020, Spring 2021, Fall 2021, Fall 2022)**

- Awarded for top academic 25%.

## **LEADERSHIP/SERVICE/CAMPUS EMPLOYMENT**

### **Science Bus**

- Teacher, September 2022–December 2022, February 2023–May 2023; Lesson writer, September 2023–December 2023
- Traveled to San Jose Elementary School in Pomona, CA every other Friday to lead hands-on lessons and explorations of various topics in science, from the striations of glaciers, to the physics of pulleys.
- Worked with 4th, 5th, and 6th grade students, a majority of whom were BIPOC and others who were the children of immigrant farm workers.

### **Journal Club**

- Lead organizer, Summer 2023
- Organized weekly get-together to read and discuss research papers in physics with fellow summer research students at Harvey Mudd College.

### **Pomona College Center for Speaking, Writing, and the Image (C.S.W.I.M)**

- Writing Partner, September 2022–December 2022, February 2023–May 2023; Attached Writing Partner for “Science and Religion”, August 2023–December 2023
- Met with fellow Pomona undergraduates 1-1 weekly for two one hour meetings to discuss their writing, ranging from literary critiques to creative works to lab reports.
- Participated in writing workshops and actively collaborated with other writing partners to refine our techniques and build community.

### **Pomona College Academy for Youth Success (P.A.Y.S.)**

- Tutor, September 2022–December 2022
- Met with local high school students every Sunday for help on subjects ranging from chemistry to calculus.
- Helped build community and a network of academic support for underrepresented students.

### **Linear Algebra Mentoring**

- Mentor/Grader, Fall 2021 and Spring 2022
- Hosted two two-hour mentoring sessions per week independently.

- Strove to provide community among the class members outside of class and facilitate an exchange of ideas from all people.
- Graded  $\frac{1}{3}$  of the weekly class homework.

#### **W.A.V.E. Writers**

- Counselor/student leader and curriculum co-author, Summer 2020 (online) and 2021 (in person)
- Along with three other peers from my high school lead a week-long free summer writing camp for 4th and 5th graders in Pacific Grove, California.
- Co-created the curriculum with one of the members: designed collaborative story building exercises as well as fun, engaging riddles and poetry.

#### **LITERARY PUBLICATIONS**

- Spring 2023, *Northwest Review*: An interview with Jonathan Lethem on the influence of generative AI on literature <https://nwreview.org/journal/52/02/oscar-scholin/>
- Spring 2022, *Northwest Review*: An essay on Adam McKay's film "Don't Look Up": <https://nwreview.org/journal/51/02/oscar-scholin/>
- Spring 2021, Pomona College's *essay* magazine: Excerpts from an exploratory essay proposing a scheme for rigorously classifying consciousness.
- I keep a poetry website: <https://oscars47.github.io/garbage-collector/>