SALEH NAGHDI

QUAD FELLOW – UNIVERSITY MEDALLIST – CHANCELLOR'S SCHOLAR

ABOUT ME

With over two years of research experience in quantum machine learning, I have helped design quantum algorithms for simulating exotic phenomena in quantum thermodynamics, as well as for identifying patterns in datasets that classical computers cannot identify. Currently I work as a core researcher for the inaugural quantum algorithms team at Australia's world-leading quantum company, Silicon Quantum Computing.

CONTACT

EMAIL:
irnamosa@gmail.com

Link to projects:
https://drive.google.com/drive/folders/1GJIwy8IXIdZdVH9kvYUANSvPuIGRP8O6?usp=sharing

PUBLICATIONS

Statistical Zero Knowledge Problems for the Quantum Support Vector Machine
Saleh Naghdi, Casey Myers, Michelle Simmons
(https://drive.google.com/file/d/1NjtSiQwuP2k62Ci0iDG1S9OWuhmbRVs6/view?usp=sharing)
To be submitted to PRX Quantum. Thesis under IP.

Inducing heat reversal on a three-qubit spin chain
Saleh Naghdi, Thomas Quella, Charles D. Hill
(https://arxiv.org/abs/2205.09300)
To be submitted to an international scientific journal.
presented at the 2022 Quantum Australia Conference; 2022 Unimelb School of Mathematics and Sciences October Seminar; 2021 Unimelb Faculty of Physics Colloquium; 2022 IBM Quantum Hackathon; 2022 UNSW Faculty of Physics Research Exposition.

PROJECTS

Quantum Feature Extraction: A Literature Review

Generative learning with Quantum Boltzmann Machines

Decision Trees for B Meson Classification

General Adversarial Networks for simulating fluorescence microscopy

EDUCATION

The University of New South Wales **Feb 2022 – Nov 2022**
Bachelor of Science (Honours) (University Medal) *High Distinction: 94.5*

- Thesis: *A Generalisation of Classically Intractable Learning Problems Solvable with Quantum Machine Learning* (supervised by Prof. Michelle Simmons and Dr. Casey Myers).
- University Medal for Physics. UNSW Physics Staff Prize for Honours (top in cohort). The UNSW Godfrey Award in Theoretical Physics. Best Student Research Award in Physics. UNSW Science Vacation Research Scholarship.

The University of Melbourne **2019 – 2021**
Bachelor of Science (Chancellor's Scholars) *First Class Honours:* 91.4
Concurrent Diploma in Computing *First Class Honours:* 89.5

- Major in Mathematical Physics and minor in Arabic.
- Melbourne Chancellor's scholarship (40 students, nationwide). AMSI Research Scholarship. Laby Research Scholarship (x2). Dean's Honours list (x2). Kwong Lee Dow Scholarship.

Werribee Secondary College **2013 – 2018**

- Achieved an ATAR of 99.90 (top 0.1% in state of Victoria).

WORK AND RESEARCH EXPERIENCE

Silicon Quantum Computing (SQC) **2022 – present**

Quantum Algorithms Associate Mar 2023 – present

- Currently working on analogue quantum machine learning by utilizing SQC's quantum dot arrays (whose dynamics are governed by the QMA-complete extended Hubbard model) to create a quantum feature map that surpasses classical data featurization techniques.
- Expanded work from Honours thesis into an academic paper titled "*Statistical Zero Knowledge Problems for the Quantum Support Vector Machine*" intended for submission to PRX Quantum.

Casual Academic May 2022 – Aug 2022

- Simulated an eight-qubit implementation of quantum PCA and performed dimensionality reduction on the MNIST dataset of Handwritten Digits.
- Adapted the circuit to SQC's silicon-based qubits and showcased superior fidelities compared to superconducting qubits.
- Supervised by Prof. Michelle Simmons and Dr. Casey Myers

IBM Quantum Hub, The University of Melbourne **Mar 2021 – May 2022**
Quantum Simulations Researcher

- Simulated the phenomenon of heat reversal within a quantum correlated three-qubit spin chain on the IBM quantum computers.
- Theoretically formulated physical set-up of a thermally interacting spin chain.
- Developed and implemented initial state preparation routine.
- Minimised noisy readout by significantly reducing circuit depth of the Hamiltonian simulation operation using a Cartan decomposition.
- Manuscript to be submitted to an international scientific journal. Presented in various talks (see Publications)
- Supervised by Dr. Thomas Quella and Dr. Charles Hill.

Australian Mathematical Sciences Institute (AMSI) **Dec 2020 – Feb 2021**
Vacation Scholar
- Visualised the loss landscape of the Quantum Boltzmann Machine (QBM) for three configurations, illustrating the roles of the three types of model parameters.
- Implemented a QBM on the IBMQ computers learning a toy probability distribution. Presented findings at internal seminar.
- Supervised by Dr. Thomas Quella and Dr. Charles Hill

Faculty of Physics, The University of Melbourne **Feb 2021 – Mar 2021**
Vacation Scholar
- Developed evaluation metrics for the use of the Fast Boosted Decision Tree in B meson classification (supervised by Prof. Martin Sevior).
- Contributions incorporated into the Belle II software framework.

Centre of Excellence for Quantum Computation and Communication Technology (CQC2T) **Feb 2020 – Mar 2020**
Vacation Scholar
- Compared various quantum software toolkits (e.g. Qiskit, PyQuil, etc.) to that of the University of Melbourne's educational kit "Quantum User Interface" (QUI) in their ability to instructively implement Grover's algorithm.
- Supervised by Prof. Lloyd Hollenberg.

Walter and Eliza Hall BioInstitute **Dec 2019 – Jan 2020**
Vacation Scholar
- Simulated the effect of fluorescence microscopy provided only transmitted light images using general-adversarial networks (in silico labeling).
- Supervised by Dr. Lachlan Whitehead and head of the computational imaging division, Prof. Kelly Rogers.

AWARDS AND RECOGNITIONS

The UNSW University Medal for Physics (the University's most distinguished recognition of an undergrad) *2023*

Government House Invitation from Governor of Victoria, Linda Dessau *2023 & 2019*

The Quad Fellowship (awarded to 100 students from the U.S., India, Australia, and Japan. Pool: >3200) *2022*

UNSW Physics Staff Prize for Honours (top all-round student in the Physics Honours cohort of 20 students) *2022*

Best Student Research Award at the UNSW Faculty of Physics Research Exposition *2022*

The UNSW Gordon and Mabel Godfrey Award in Theoretical Physics (top academic performance in cohort) *2022*

UNSW Science Vacation Research Scholarship by Australian of the Year, Prof. Michelle Simmons *2022*

AMSI Vacation Research Scholarship *2021*

Laby Research Scholarship *2020 & 2021*

Dean's Honours List (top 3% of cohort) *2019 & 2020*

The Melbourne Chancellor's Scholarship (awarded to the top 0.1% of high school leavers, nationwide) *2019*

Premier's VCE Award: Top All-Round VCE High Achiever (Awarded to 23 students statewide) *2019*

EXTRACURRICULAR ACTIVITIES, VOLUNTEERING AND OTHER WORK

Quad Fellowship Summit in Melbourne
Jun 5 – Jun 10, 2023
- Met with Ambassador Caroline Kennedy, the Honourable Linda Dessau, Nobel Laureate Brian Schmidt, Schmidt Futures CEO Eric Braverman among others.
- Delivered a lightning talk on Quantum Machine Learning.

IBM Qiskit Advocate
2022 – present
- Developing a transpiler pass to convert Qiskit Quantum Circuit objects to ZX Calculus graphs and back for optimisation.

UMSU Queer Space:
2021 – 2021
- Attended fortnightly discussion sessions on queer advocacy at UMSU queer space.

Practical demonstrator and Tutor at UNSW and Warrane College
June 2022 – Nov 2022
- Weekly tutoring of first- and second-year students for physics and mathematics.
- Private tutoring from 2019 to 2020 for senior students taking senior-level English, Chemistry, Physics and Mathematics

Pianist for College Band
2022
- Fortnightly performances at formal events hosted by the college.

Debater at Melbourne University Debating Society
2020 – 2021
- Weekly debating in both Debating Association Victoria (DAV) and British Parliamentary (BP) styles.
- Participation in competitions including Australian Easters 2021, Monash Mini 2021, Melbourne Mini 2020.

Public Relations Executive and Tutor for Student Science Squad
2020
- Collaborating with fellow Chancellor's scholars during the Covid-19 pandemic to provide free tutoring for students whose learning had been disrupted by the onset of state-wide school closures.

REFERENCES

Name	**Prof. Michelle Simmons**	**Dr Charles Hill**	**Dr Thomas Quella**
Organization	• The University of New South Wales • ARC Center of Excellence for Quantum Computation and Quantum Technology (CQC^2T) • Silicon Quantum Computing Pty. Ltd. (SQC)	The University of Melbourne	The University of Melbourne
Position	• Scientia Professor • Employer • Centre Director	Senior Lecturer	Senior Lecturer
Relationship	Honours Supervisor and Employer	Academic supervisor	Academic Supervisor
Telephone	+61 2 9385 6313	+61 403 535 892	+61 83446796
Email	michelle.simmons@unsw.edu.au	charles.hill1@unsw.edu.au cdhill@unimelb.edu.au (Alumni email)	thomas.quella@unimelb.edu.au