

Mária (Marika) Kieferová

quantum computing and quantum algorithms researcher

Work Experience

- November 2021 – **Australia Quantum Program Lead**,
Google Quantum AI, Australia.
- August 2021 – **Lecturer**,
University of Technology Sydney & The ARC Centre of Excellence for Quantum Computation and Communication Technology, Australia.
- August 2019 – August 2021 **Postdoc**,
University of Technology Sydney & The ARC Centre of Excellence for Quantum Computation and Communication Technology, Australia
supervisor: Prof. Michael Bremner.
- October 2019 – **Quantum Consultant**,
December 2020 Zapata Computing,
(remote work).
- September 2018 – **Research Intern**,
December 2018 Zapata Computing,
United States.
- June 2016 – Sept 2016 **Research Intern**,
Microsoft Research,
United States.
- July 2011– Aug 2014 **Undergraduate Research Assistant**,
Research Center for Quantum Information, Slovak Academy of Sciences,
Slovakia.
- July 2012– Sept 2012, **Research Intern**,
June 2013– Sept 2013 Institute for Quantum Computing,
Canada.

Education

- May 2017 – April 2020 **Physics**, PhD – cotutelle
Macquarie University, Australia
Supervisor: Assoc. Prof. Dominic Berry
Co-supervisor: Prof. Gavin Brennen
Thesis: Quantum Algorithmic Techniques for Fault-Tolerant Quantum Computers.
- Sept 2014 – November 2019 **Physics – Quantum Information**, PhD
Institute for Quantum Computing, University of Waterloo, Canada,
Supervisor: Prof. Michele Mosca
Thesis: Quantum Algorithmic Techniques for Fault-Tolerant Quantum Computers.

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Sept 2012 – June 2014 **Theoretical Physics**, Masters
Comenius University, Slovakia
Supervisor: Dr. Daniel Nagaj
Master Thesis: The Adiabatic Theorem in Physics & Computation
Graduated with honors.

Sept 2009 – June 2012 **Physics**, Bachelors
Comenius University, Slovakia
Supervisor: Dr. Daniel Nagaj
Bachelor Thesis: Continuous-Time Quantum Walks
Graduated with honors.

Service & Leadership

- July 2021 – **Sydney Quantum Academy**,
Member of the Technical Advisory Committee.
- March 2020 – **IOP journal Quantum Science and Technology**,
Associate Editor.
- January 2020 – **Sydney Quantum Academy**,
Member of multiple selection committees.
- April 2022 **Quantum Computing Theory in Practice**,
Program Committee member.
- March 2022 **Annual Conference on Quantum Information Processing (QIP)**,
Program Committee member.
- June 2021 **IEEE Quantum Week**,
Technical Program Committee member.
- March 2021 **The 16th Conference on the Theory of Quantum Computation, Communication, and Cryptography**,
Program Committee member.
- December 2020 **The 20th Asian Quantum Information Science Conference**,
Local organizer.
- August 2020 **Quantum Techniques in Machine Learning 2020**,
Program Committee member.
- March 2020 – July 2020 **Quantum Open Source Foundation**,
Mentoring quantum computing enthusiasts.
- July 2020 **IEEE Quantum Week**,
Technical Program Committee member.
- October 2019 **Annual Conference on Quantum Information Processing (QIP)**,
Program Committee member.
- April 2019 **Central European Quantum Information Processing Workshop**,
Program Committee member.
- 2016 – 2019 **LEAF – Talent guide**,
Mentoring for gifted Slovak students.
- Mar 2013– May 2013 **Academic Senate of The Faculty of Mathematics, Physics and Informatics Comenius University**,
Elected student representative.
- 2012 **Young Physicist Tournament**,
Coaching the winning team at a national competition.
- 2009– 2013 **Physics Correspondence Competition**,
Organizer of a competition for high school students.

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Awards

- Sept 2020 IOP trusted reviewer certificate
- Jun 2020 W.B. Pearson Medal, Waterloo, Canada
- Jan 2020 Best poster, QIP, Shenzhen, China
- Sept 2019 IQC Achievement Award, Canada
- Jan 2013 Best poster, QIP, Beijing, China
- Oct 2009 Slovak Ministry of Education award – Pamätný list sv. Gorazda
- July 2009 Bronze medal on the 22nd International Young Physicists Tournament, captain of the Slovak team, China
- May 2009 1st place Young Physicists Tournament Slovakia, captain

Funding

- March 2022 **DARPA**,
Quantifying Utility of Quantum Computers,
Chief Investigator, TBA.
- July 2021 **Zapata Computing**,
Exploring the practicality of quantum algorithms for solving differential equations,
Sole Chief Investigator 14,920 AUD.
- June 2021 **NSW Defence Innovation Network**,
Defence acquisition optimisation using quantum algorithms,
Chief Investigator 149,829 AUD.
- February 2021 **Australian Research Council (ARC) Linkage, Infrastructure, Equipment and Facilities (LIEF) grant**,
Multifunctional deposition system for advanced superconducting circuits,
Chief Investigator, 699,644 AUD.
- November 2020 **Sydney Quantum Academy Postdoctoral Fellowship**,
Quantum advantage with quantum machine learning,
Sole Chief Investigator, 3 year funding, 400,000 AUD.
- July 2013 **Mike and Ophelia Lazaridis Fellowship**,
PhD funding, 80,000 CAD.

Teaching

- Spring 2022 **Coordinator and a lecturer, Methods in Quantum Computing**,
FEIT, University of Technology Sydney.
- March 2022 **Quantum Machine Learning**,
Annual Conference on Quantum Information Processing - Tutorial, Caltech, USA.
- Spring 2021 **Coordinator and a lecturer, Methods in Quantum Computing**,
FEIT, University of Technology Sydney.
- Fall 2021 **Guest lecturer, Quantum algorithms**,
FEIT, University of Technology Sydney.
- 2021 – **Informal supervisor of a PhD student**,
FEIT, University of Technology Sydney.
- 2019 – 2020 **Informal co-supervisor of an honors student**,
FEIT, University of Technology Sydney.
- Spring 2020 **Guest lecturer, Methods in Quantum Computing**,
FEIT, University of Technology Sydney.

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- 2011 – 2018 **Private tutor.**
- Fall 2016, Fall 2015 **Teaching assistant, Quantum Mechanics,**
University of Waterloo, Canada.
- Fall 2014 **Teaching assistant, Mechanics,**
University of Waterloo, Canada.
- Fall 2013 **Teaching assistant, Quantum Theory 1,**
Comenius University, Slovakia.

Bibliometrics

Google Scholar.

https://scholar.google.ca/citations?user=0n96N_0AAAAJ&hl=en

ORCID ID.

<https://orcid.org/0000-0002-0749-8126>

Publications

- [1] Y. Cao, J. Romero, J. P. Olson, M. Degroote, P. D. Johnson, M. Kieferová, I. D. Kivlichan, T. Menke, B. Peropadre, N. P. Sawaya, *et al.*, “Quantum chemistry in the age of quantum computing,” *Chemical Reviews*, vol. 119, no. 19, pp. 10856–10915, 2019.
- [2] M. Kieferova and N. Wiebe, “Tomography and generative training with quantum Boltzmann machines,” *Physical Review A*, vol. 96, no. 6, p. 062327, 2017.
- [3] R. D. Somma, D. Nagaj, and M. Kieferová, “Quantum speedup by quantum annealing,” *Physical Review Letters*, vol. 109, no. 5, p. 050501, 2012.
- [4] D. W. Berry, M. Kieferová, A. Scherer, Y. R. Sanders, G. H. Low, N. Wiebe, C. Gidney, and R. Babbush, “Improved techniques for preparing eigenstates of fermionic Hamiltonians,” *npj Quantum Information*, vol. 4, no. 1, pp. 1–7, 2018.
- [5] M. Kieferová and N. Wiebe, “On the power of coherently controlled quantum adiabatic evolutions,” *New Journal of Physics*, vol. 16, no. 12, p. 123034, 2014.
- [6] M. Kieferová, A. Scherer, and D. W. Berry, “Simulating the dynamics of time-dependent Hamiltonians with a truncated Dyson series,” *Physical Review A*, vol. 99, no. 4, p. 042314, 2019.
- [7] M. Kieferova and D. Nagaj, “Quantum walks on necklaces and mixing,” *International Journal of Quantum Information*, vol. 10, no. 02, p. 1250025, 2012.
- [8] S. Raeisi, M. Kieferová, and M. Mosca, “Novel technique for robust optimal algorithmic cooling,” *Physical Review Letters*, vol. 122, no. 22, p. 220501, 2019.
- [9] C. O. Marrero, M. Kieferová, and N. Wiebe, “Entanglement-induced barren plateaus,” *PRX Quantum*, vol. 2, no. 4, p. 040316, 2021.
- [10] P. K. Faehrmann, M. Steudtner, R. Kueng, M. Kieferova, and J. Eisert, “Randomizing multi-product formulas for improved Hamiltonian simulation,” *arXiv:2101.07808*, 2021.
- [11] M. Kieferová, C. O. Marrero, and N. Wiebe, “Quantum generative training using Rényi divergences,” *arXiv:2106.09567*, 2021.
- [12] M. Kieferová and Y. R. Sanders, “Assume a quantum data set,” 2022.
- [13] Google Quantum AI, “Formation of robust bound states of interacting photons,” *arXiv:2206.05254*, 2022.

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- [14] Google Quantum AI, "Suppressing quantum errors by scaling a surface code logical qubit," *arXiv: 2207.06431*, 2022.

Intellectual Property

- 2018 Tomography and generative data modeling via quantum Boltzmann training, US Patent App. 15/625,712
- 2020 Method for decreasing entropy in a quantum system, US Patent App. 16/268,005
- 2020 Hybrid Quantum-Classical Computer for Packing Bits into Qubits for Quantum Optimization Algorithms, US Patent App. 16/691,015

Selected Talks

- March 2022 **Quantum Barren Plateaus and Generative Pre-Training**, Tsinghua, China.
- July 2021 **Quantum computing: disentangling the hype**, Australian Astronomical Optics, Australia.
- July 2021 **Challenges and opportunities in quantum machine learning**, Goldman Sachs, US.
- June 2021 **Quantum Barren Plateaus and Generative Pre-Training**, CAP Congress, Canada.
- May 2021 **Quantum Barren Plateaus and Generative Pre-Training**, Quantum Information for Mathematics, Economics, and Statistics, Chicago, USA.
- May 2021 **Quantum Barren Plateaus and Generative Pre-Training**, CQT, Singapore.
- April 2021 **Quantum machine learning: is this the future or is this just fantasy?**, ETH, Switzerland.
- March 2021 **My work as a quantum algorithms researcher**, Women in Quantum Summit IV.
- November 2020 **Entanglement induced barren plateaus**, QTML, USA.
- July 2020 **Hamiltonian simulations**, NASA, USA.
- April 2020 **Oblivious algorithmic cooling**, BQIT, UK.
- January 2020 **Simulating quantum systems on a digital quantum computer**, CQC2T annual meeting, Australia.
- October 2019 **Practical applications of quantum computing**, CEBIT, Australia.
- October 2019 **Oblivious algorithmic cooling**, New paradigms in Quantum Control Workshop, Australia.
- June 2019 **Techniques for preparing eigenstates of fermionic Hamiltonians**, Freie Universität Berlin, Germany.
- June 2019 **Quantum sorting**, University of Oxford, Oxford, UK.
- June 2019 **Simulating the dynamics of time-dependent Hamiltonians with a truncated Dyson series**, Central European Quantum Information Processing Workshop, Slovakia.
- June 2017 **Quantum Boltzmann machines for generative training and tomography**, TQC – QML Sydney, Australia.
- June 2015 **On the power of coherently controlled adiabatic evolution**, University of Calgary, Canada.
- Aug 2013 **Quantum speedup by quantum annealing**, Microsoft Research, USA.

Other Skills

- Languages Slovak, Czech – native, English – fluent
- Computer skills C++, Python, Mathematica, Linux shell scripting, \LaTeX

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