

PROFILE

- Developing *ab initio* simulations to model the physics of nanoelectronic devices at an atomistic scale.
- Academic background in solid state physics, nanoelectronics, and computational linear algebra.
- Interested in emerging memory technologies, neuromorphic computing architectures, and physical neural networks

EDUCATION

ETH Zurich

Candidate for PhD, Information Technology and Electrical Engineering

Zurich, Switzerland

September 2021–present

University of Waterloo

Master of Applied Science (MAsc), Electrical and Computer Engineering

Waterloo, ON, Canada

September 2019–May 2021

University of Waterloo

Bachelor of Applied Science (BAsc), Nanotechnology Engineering. Graduated with distinction.

Waterloo, ON, Canada

September 2014–May 2019

EXPERIENCE

PhD Candidate - ETH Zürich

Advisor: Dr. Mathieu Luisier, Professor

Zürich, Switzerland

September 2021 - current

- Developing atomistic models for resistive switching in Valence Change Memory (VCM) cells, using electronic structure calculations, *ab initio* quantum transport, and Kinetic Monte Carlo. Working with experimental partners at ETH and IBM Zurich to realize new device structures and investigate their operating mechanisms.

MAsc Student - University of Waterloo

Advisor: Dr. Youngki Yoon, Associate Professor

Waterloo, ON, Canada

September 2019 - July 2021

- Strain- and defect-engineered the performance of 2D Transition-Metal-Dichalcogenide (TMD) electronic and optoelectronic devices using *ab-initio* simulations. Collaborated with experimental partners at Sungkyunkwan University to fabricate and test devices.

Research Assistant - Waterloo Institute for Nanotechnology (WIN)

Supervisor: Dr. Dayan Ban, Professor

Waterloo, ON, Canada

January 2018 - August 2018

- Wrote a model to simulate the operation of Resonant-Phonon Quantum Cascade Lasers, based on self-consistently solved wavefunctions and charge distributions. Implemented Markov-Chain Monte-Carlo optimization methods to search for designs with higher-temperature lasing potential. Assisted in optical characterization of fabricated devices.

Formulations Engineering Intern - Adaptive Surface Technologies (AST)

Supervisor: Dr. Tehila Nahum, Principle Formulations Engineer

Cambridge, MA, USA

August 2016 - April 2017

- AST develops slippery coatings on the principle of infusing a nanoporous surface with a lubricant. Worked in a team of three engineers to formulate food-safe container coatings for a customer in the consumer packaging industry.

Research Assistant - National Institute of Materials Science (NIMS)

Supervisor: Dr. Genki Yoshikawa, Associate Professor and Group Leader

Tsukuba, Ibaraki, Japan

January 2016 - April 2016

- Optimized the morphology of active-layer films on a membrane-type olfactory nanosensor, using a combination of experimental testing and COMSOL modelling

Research Assistant - Canadian Nuclear Laboratories (CNL)

Supervisor: Dr. Syed Bukhari, Research Associate, Neutron Scattering Branch

Chalk River, Ontario, Canada

May 2015 - August 2015

- Optimized sputtering parameters to minimize the interfacial roughness between stacked metal-alloy thin films

TEACHING & SUPERVISION

Teaching Assistant Positions

- **Quantum Transport in Nanostructures, ETH Zurich** February 2022 - April 2022
Taught one third of the tutorials.
- **Linear Circuits (NE140), University of Waterloo** January 2021 - April 2021
Prepared and taught all remote (synchronous) tutorials.
- **Nanoelectronics (NE471), University of Waterloo** September 2020 - December 2020
Held office hours for student questions, prepared assignments, and marked exams.
- **Electronic Circuits (NE344), University of Waterloo** May 2020 - August 2020
Prepared and taught all remote (synchronous) tutorials.
- **Linear Circuits (NE140), University of Waterloo** January 2020 - April 2020
Prepared and taught all tutorials.

Student Project Supervisions

- **Masters' semester project of Jente Clarysse, ETH Zurich** September 2022 - January 2023
Developing semi-classical models of current flow through amorphous oxides, and integrating them into a Kinetic Monte Carlo code to investigate thermally-activated resistive switching phenomena.
- **Masters' semester project of Zhouyang Yu, ETH Zurich** September 2022 - January 2023
Performing quantum transport simulations on Interband Cascade Lasers (ICLs). Co-supervising with Matheiu Luisier.
- **Bachelor Thesis of Patrik Gjini, ETH Zurich** February 2022 - May 2022
Implemented a Fast Multipole Method algorithm to accelerate the solution of Poisson's equation in across amorphous structures. Co-supervised with Marko Mladenovic.
- **Masters' semester project of Patrick Bütler, ETH Zurich** February 2022 - May 2022
Investigating phase transition-induced resistive switching in monolayer MoTe₂ towards non-volatile memory applications. Co-supervised with Jonathan Backman.

OTHER ACTIVITIES

Team Lead - UW Nano Robotics Group (UWNRG)

Advisor: Dr. Mustafa Yavuz, Associate Professor

Waterloo, ON, Canada

January 2015 - July 2019

- UWNRG designs microbotic actuation systems to compete at the annual IEEE ICRA Microbotics Challenges.
- Led the development of a microbot called SAM (Solenoid Actuated Microbot). Managed funding applications for lab expenses, equipment, cleanroom usage, and conference travel costs.
- Competition Record: 3rd place (at ICRA 2015), 1st place (at ICRA 2016), 2nd place (at ICRA 2018).

SCHOLARSHIPS & AWARDS

- Top 10% (out of 715) Poster Commendation at the Psi-K Conference 2022
- NSERC PGSD Doctoral Award (for three years) 2021
- Waterloo Faculty of Engineering Awards (x2) 2020
- Sanford Fleming Foundation (SFF) Teaching Assistant Excellence Award 2021
- Waterloo Graduate Research Studentship (with MASc offer) 2019–2021
- Waterloo Dean's Entrance Award (Graduate) 2019
- Presentation Award, Waterloo Nanotechnology Symposium 2019
- Waterloo Undergraduate Research Assistantship Awards (x2) 2017–2018
- Waterloo Undergraduate Research Internship Awards (x2) 2017–2018
- NSERC Undergraduate Student Research Awards (USRA) (x2) 2017–2018
- Waterloo International Internship Award 2016
- NIMS (Japan) Internship Program Fellowship 2016
- Waterloo President's (Entrance) Scholarship 2014

JOURNAL ARTICLES (* = EQUALLY CONTRIBUTED)

In Press/Published:

1. **M. Kaniselvan**, M. Luisier, and M. Mladenovic, "An Atomistic Modelling Framework for Valence Change Memory Cells," *Solid State Electronics: LETTERS from the International Conference on Simulation of Semiconductor Processes and Devices 2022*, October 2022 doi: 10.1063/2F5.0053789
2. **M. Kaniselvan**, M. Sritharan, and Y. Yoon, "Mitigating Tunneling Leakage in Ultrascaled HfS₂ pMOS Devices with Uniaxial Strain," *IEEE Electron Device Letters*, June 2022 doi:10.1109/LED.2022.3179228 (**Editor's Pick**)
3. **M. Kaniselvan** and Y. Yoon, "Strain-tuning PtSe₂ for high ON-current lateral tunnel field-effect transistors," *Applied Physics Letters*, vol. 119, no. 7, p. 073102, Aug. 2021. doi:10.1063/2F5.0053789
4. G. Han, **M. Kaniselvan**, and Y. Yoon, "Photoresponse of MoSe₂ Transistors: A Fully Numerical Quantum Transport Simulation Study," *ACS Applied Electronic Materials*, vol. 2, no. 11, pp. 3765–3772, Nov. 2020. doi:10.1021/acsaelm.0c00795
5. M. Naqi*, **M. Kaniselvan***, S. Choo*, G. Han, S. Kang, J. Kim, Y. Yoon, and S. Kim, "Ultrasensitive Multilayer MoS₂-Based Photodetector with Permanently Grounded Gate Effect," *Advanced Electronic Materials*, vol. 6, no. 4, p. 1901256, Feb. 2020. doi: 10.1002/aelm.201901256.

Submitted/In Review:

6. M. Sritharan, R.K.A Bennett, **M. Kaniselvan**, and Y. Yoon, "A Comparative Study on 2D Materials with Native High-Oxides for Ultrascaled Transistors," under revision at *IEEE Transactions on Electronic Devices*.
7. H. Park*, A. Sen*, **M. Kaniselvan**, A.AlMutairi, A. Bal, L. Lee, Y.Yoon, and S. Kim, "Active-matrix image sensor array based on wafer-scale nanoporous bilayer MoS₂," under revision at *Advanced Materials*.
8. **M. Kaniselvan**, M.Luisier, and M. Mladenovic, "Atomistic Modelling of Field-Induced Resistive Switching in Valence Change Memory," submitted.

TALKS & POSTERS

Refereed:

1. **Manasa Kaniselvan**, Mathieu Luisier and Marko Mladenovic *An Atomistic Modelling Framework for Valence Change Memory Cells*. International Conference on Simulation of Semiconductor Processes and Devices (SISPAD), Granada, Spain, August 2022. Talk.
2. **Manasa Kaniselvan**, Marko Mladenovic, Patrik Gjini, and Mathieu Luisier *Modelling transport in valence change memory cells*. Psi-k Conference, Lausanne, Switzerland, August 2022. Poster.

Not Refereed:

3. **Manasa Kaniselvan**, Marko Mladenovic, Patrik Gjini, and Mathieu Luisier *Modelling transport in valence change memory cells*. CECAM Workshop on "Quantum transport methods and algorithms: from particles to waves approaches", ETH Zürich, Switzerland, July 2022. Poster.
4. Marko Mladenovic, **Manasa Kaniselvan**, and Mathieu Luisier *Ab-Initio-Parametrized Kinetic Monte Carlo Model for Vacancy Diffusion in Amorphous Oxides in Valence Change Memory*. First Principles Modelling of Defects in Solids Workshop, ETH Zürich, June 2022. Poster.
5. **Manasa Kaniselvan**. *Engineering the Performance of 2D Transition Metal Dichalcogenide Nanotransistors through Quantum Transport Simulations*. Nanotechnology Seminar delivered at the University of Waterloo, June 2021. Talk.
6. Boyu Wen, Chao Xu, Siyi Wang, Sm Shazzad Rassel, **Manasa Kaniselvan**, Chris Deimert, Zbigniew Wasilewski and Dayan Ban *Novel 4-well THz QCL with hybrid injection/extraction channels*. ITQW2019: Infrared Terahertz Quantum Workshop.
7. Mary Chen*, **Manasa Kaniselvan***, Corin Seeleman*, Danielle Smith*. *A Real-Time Non-Invasive Sensor for Monitoring Laser-Induced Temperature in Medical Applications*. Waterloo Engineering Design Symposium 2019. Waterloo, ON, Canada. Oral presentation & poster.
8. **UW Nano Robotics Group**. *Solenoid Actuated Microbot (SAM)*. 2018 IEEE IEEE International Conference on Robotics and Automation (ICRA). Brisbane, Australia. Competition & poster.