

Phillip Suwan Kirwin

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Education

MASc Electrical and Computer Engineering, University of British Columbia

Anticipated Completion: 2024 August

Supervisors: Lukas Chrostowski (ECE), Jeff Young (Physics)

Research Topics: Quantum silicon photonics, Photonic quantum computing

BSc Electrical Engineering (Nanotechnology, Co-op), University of Alberta

Degree Completed: 2021 December

Cumulative Grade Point Average: 4.0/4.0

Selected Courses: Photonics, Nanoelectronics, Numerical simulations, Microfabrication, MW circuits

Academic Awards

NSERC CREATE in Quantum Computing Scholar, 2022 – 2024

NSERC Canada Graduate Scholarship – Master's, 2022 – 2023

Fluor Canada Ltd Award, 2018, 2020

Jason Lang Scholarship, 2017 – 2020

NSERC Undergraduate Student Research Award, 2019

Dean's Research Award, 2019

ABB Ltd Scholarship, 2019

University of Alberta Academic Excellence Scholarship, 2016

Alberta Thai Association Scholastic Achievement Award, 2016

Technical Skills

Simulation – Lumerical, Sentaurus TCAD, FDTD, FEM

CAD – KLayout, EAGLE, MicroStation, AutoCAD

Fabrication – Lithography, PVD, Reactive ion etching, sonication

Optics – Pump-probe microscopy, bulk optics, modulation, NIR/vis imaging, magneto-optics

Electronics – DAQ circuit design, MW circuits, EAGLE EDA, PathWave ADS, VNA

Mathematical software – MATLAB, Mathematica, Origin, Igor, LabVIEW

Languages – C, C++, Java, Python, TCL, Scheme, LaTeX

Experience

University of Alberta, Edmonton, AB

May – December 2021

Research Assistant – Integrated Optics Lab (Supervisor: Dr. Ray DeCorby)

- Hexagonal boron nitride single photon emitters in integrated buckled dome microcavities
 - Designed and scripted Lumerical FDTD simulations for emitters in high-Q half-symmetric cavities
 - Simulations showed that straining structures can be engineered to obtain near-optimal Purcell enhancement
 - Observed and conducted microfabrication processes including sputtering, maskless photolithography, etching, sonication, dicing, annealing, sample imaging, stress characterization, ellipsometry
- Wide blocking range NIR tunable bandpass filter based on resonant tunneling
 - Performed optical alignment on optical table, free-space coupling of SMFs
 - Conducted spectral intensity characterization experiments
 - Worked with SMF, MMF, collimators, OSA, supercontinuum laser, lenses, NIR/vis cameras

Nippon Telegraph and Telephone R&D, Atsugi, Kanagawa, Japan

February – October 2020

Research Intern – Quantum Optical Physics Group (Supervisor: Dr. Yoji Kunihashi)

- Designed and conducted experiments using time-resolved pump-probe Kerr microscopy for the characterization of ensemble spin dynamics in dilute bulk GaAsBi
- Found evidence of anomalous electron spin behaviour arising from localized Bi states
- Worked in an optical lab with pulsed/CW tunable lasers (M Squared, Spectra-Physics), passive optical components, LPCs, lock-in amplifiers, photodetectors, PEMs, AOMs, fibers, etc.
- Developed mathematical description of polarization behaviour in experiments based on general cases in existing literature

University of Alberta, Edmonton, AB

May – December 2019

Undergraduate Researcher – Excitonics and Nanostructures Lab (Supervisor: Dr. Karthik Shankar)

- Developed coupled optical (FDTD) and electrical simulations for nanostructured perovskite solar cells using Sentaurus TCAD
 - Showed that closely spaced TiO₂ nanorods of optimized dimensions can increase light absorption, possibly through multiple scattering and hotspots.
- Performed photoconductivity experiments on CdS-based photocatalysts and showed that wrapping CdS nanowires in C₃N₅ nanosheets removes hysteresis from the material's current-voltage characteristic. This implied that the nanosheets reduce surface trap states in the nanowires via surface passivation, which is advantageous to photocatalytic efficiency.
- Performed electron-beam PVD for photovoltaic/photoconductive samples
- Fabricated organic solar cells using spin-coating

ECPOR Utilities Inc., Edmonton, AB

May – December 2019

Transmission Engineering Co-op Student

- Worked with team of engineers and technologists responsible for high voltage substations and transmission lines, i.e., protection & control, SCADA & communications, apparatus
- Responsible for design, material procurement, and CAD drafting of two digital fault recorders for installation at Edmonton substations
- Documentation of digital fault recorder design philosophy for future reference and standardization
- Drafted, programmed, and documented new installation of bus protection relays
- Performed transmission system fault studies in Aspen OneLiner and eTAP

University of Alberta, Edmonton, AB

December 2017 – April 2018

Research Assistant – Wishart Research Group (Supervisor: Dr. David Wishart)

- Developed and standardized an automatic testing system for electrochemical double-layer capacitors ("supercapacitors") using Arduino and Python, increasing efficiency of data acquisition for other researchers
- Documented design, calibration, standard usage and troubleshooting of said system
- Assisted in creating and operating various apparatuses for the fabrication and analysis of supercapacitors, such as ball mills, 3D printers, pressure sensors

Peer Reviewed Journal Publications

- [J2] K. G. Scheuer, P. S. Kirwin, R. G. DeCorby, "Monolithic buckled microcavities for hexagonal boron nitride emission enhancement," *Manuscript in progress*.
- [J1] K. M. Alam, C. E. Jensen, P. Kumar, R. W. Hooper, G. M. Bernard, A. Patidar, A. P. Manuel, N. Amer, A. Palmgren, D. N. Purschke, N. Chaulagain, J. Garcia, P. S. Kirwin, L. C. T. Shoute, K. Cui, S. Gusarov, A. E. Kobryn, V. K. Michaelis, F. A. Hegmann, K. Shankar, "Photocatalytic mechanism control and study of carrier dynamics in CdS@C₃N₅ core-shell nanowires," *ACS Applied Materials & Interfaces*, vol. 13, no. 40, pp. 47418–47439, 2021.

Conference Proceedings

[C1] K. G. Scheuer, P. S. Kirwin, R. G. DeCorby, "Coupling emission from strained hexagonal boron nitride thin films to monolithic integrated cavities," *Quantum Information and Measurement VI*, 2021.

Poster Presentations

[P2] P. S. Kirwin, L. Jack, P. Jajal, Z. Kwong, "Wireless electromyography system," *University of Alberta ECE Capstone Design Showcase*, 2021.

[P1] P. S. Kirwin, U. K. Thakur, K. Shankar, "Coupled optical-electronic simulations of halide perovskite solar cells," *University of Alberta Engineering Dean's Research Award Poster Session*, 2019.

Activities

Vice President, Academic, Electrical Engineering Club, University of Alberta

May 2018 – April 2021

- Primary liaison between undergraduate society and ECE department
- Organized and conducted review sessions for 2nd-year ECE courses for 4 years
- Co-wrote proposal for upgrade of 400-level laboratory equipment
- Mentored incoming club executives

Aikido Instructor, Tenshinkai Aikido Edmonton

2016 – present

- Presently teaching one general class per week
- Developed and improved class structures
- Planned public demonstrations

Other

- Aikido
- Hiking
- Rock climbing
- Downhill skiing
- Cycling
- Introductory Japanese I, 2018
- Junior hockey, NJHL, 2018 – 2019
- Intramural hockey, University of Alberta, 2016 – 2017