Jules van Irsel

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Professional Summary

I possess a solid foundation in the core branches of physics, with specialized expertise in plasma physics, multilingual computational physics, and data management. I am adept in mechanical and electrical computer-aided design, engineering, manufacturing, and space plasma instrument testing. With an interdisciplinary skill set, I approach challenges with curiosity, conscientiousness, and a spirit of collaboration.

Education

Dartmouth College — Hanover, NH
Doctor of Philosophy in Physics — *July 2025*

University of Calgary — Calgary, AB
Bachelor of Science (Honours), Major in Astrophysics — *June 2018*

Southern Alberta Institute of Technology — Calgary, AB
Mechanical Eng. Tech. (Honours), Major in Design and Development — *June 2014*

Professional Experience

Graduate Student — Hanover, NH
Dartmouth College – K. A. Lynch – 603 646 9311 — *Sep. 2019 – July 2025*

- Defended thesis on electric current closure in ionospheric plasmas on July 8, 2025
- Selected for two years of graduate funding from NASA's 2022 FINESST solicitation
- Contributed to the development of NASA's 2022 HLCAS selected proposal: *Geophysical Non-Equilibrium Ionospheric System Science* (GNEISS, PI: K. A. Lynch) sounding rocket mission
- Contributed to the development of NASA's 2019 MIDEX proposal through its Phase A Concept Study Report: *Auroral Reconstruction CubeSwarm* (ARCS, PI: K. A. Lynch)
- Produced a catalog of multi-fluid ionospheric 3D plasma simulations using the Geospace Environment Model of Ion-Neutral Interactions (GEMINI, github.com/gemini3d)
- Developed tools for driving GEMINI from multi-sourced, heterogeneous data products, as well as tools to visualize the resulting rich output data volumes (github.com/317Lab/aurora_gemini)
- Implemented methods for advanced impact ionization to the GEMINI source code
- Vacuum/plasma tested, and wrote GSE software for, Petite Ion Probes and oversaw their integration onto NASA's *Loss through Auroral Microburst Pulsations* (LAMP, PI: A. Halford) sounding rocket mission
- Instructed courses for both graduate and undergraduate classes while mentoring undergraduate students in the *Lynch Rocket Lab*

Instrument Design & Assembly Assistant — Calgary, AB
University of Calgary – J. K. Burchill – 403 220 8108 — *May 2018 – Aug. 2019*

- Mechanically and electrically redesigned the rocket Miniature Plasma Imager (rMPI) lowering its power consumption and introducing ion baffling
- Assisted in rMPI environment testing (vacuum, vibration, plasma) and oversaw its integration onto NASA's *Cusp-Region EXperiment 2* (C-REX 2, PI: M. Conde) sounding rocket mission
- Oversaw integration of rMPIs onto NASA's *VISualizing Ion Outflow via Neutral atom Sensing 2* (VISIONS 2, PI: D. Rowland) sounding rocket mission

Research Internship Calgary, AB
University of Calgary – J. K. Burchill – 403 220 8108 *May 2017 – Oct. 2017*

– Analyzed the European Space Agency's Swarm EFI data using a superposed epoch analysis comparing electron temperature enhancements and ion vertical flow to study ion outflow in the cusp region ionosphere

Mechanical Design Engineer & MWD Technician Calgary, AB
QCD Technologies – T. Russell – 403 235 0720 *May 2014 – Oct. 2014*

– Designed vertical shock absorber servicing tools used in Measurements While Drilling (MWD) technology using CAD

Leadership Roles & Community Involvement

Van Irsel Medical Board Member vanirselmedical.com
Consult on product and software development, including machine learning methods *Since Feb. 2025*

Department Graduate Student Treasurer Dartmouth College
Propose community funding and manage yearly budgets and reimbursements *Feb. 2024 – July 2025*

Department Building Committee Liaison Dartmouth College
Restore/refurnish community spaces, reorganizing and redesigning office spaces *Oct. 2024 – July 2025*

Selected Publications

– van Irsel, J., Lynch, K., Mule, A., Zettergren, M., et al., (2025), Current closure and Joule heating in data-driven 3-D auroral arc simulations, *Journal of Geophysical Research: Space Physics*. Manuscript in preparation.

– van Irsel, J., Lynch, K., Mule, A., Zettergren, M., (2024), Generation of top boundary conditions for 3D ionospheric models constrained by auroral imagery and plasma flow data, *Journal of Geophysical Research: Space Physics*.

– Lynch, K., Erlandson, R., van Irsel, J. et al., (2024), *Auroral Reconstruction CubeSwarm: A 2019 Heliophysics Medium-Class Explorer Phase A Concept Study Section D*.

– Erlandson, R., Lynch, K., van Irsel, J. et al., (2024), *Auroral Reconstruction CubeSwarm: A 2019 Heliophysics Medium-Class Explorer Phase A Concept Study Section E*.

Awards & Scholarships

Physics & Astronomy Chair's Service Award: For community services to the department 2025

NASA FINESST: Future Investigators in NASA Earth and Space Science and Technology 2023

NSERC USRA: Undergraduate Student Research Award (Declined) 2018

PURE Award: Program for Undergraduate Research Experience Award 2017

Technical Skills

Software: Autodesk Inventor and Showcase, Solidworks, Solidworks Visualize, Paraview, VisIt, Dipstrace

Programming Languages: Python, MATLAB, Mathematica, FORTRAN, HTML/CSS/JavaScript, C

Developer Tools: Git, VS Code, Windows Subsystem for Linux, high performance computing, multithreading, Slurm Workload Manager, Portable Batch System

Other: Computer Aided Design, surface-mount soldering, prototyping, Geometric Dimensioning and Tolerancing, precision machining

Courses

Incoherent Scatter Radar Summer School — Virtual
Theory, concepts, and hands-on experiment design for incoherent scatter radars — *July 2020*

Machine Learning — Virtual
Coursera class on *Supervised Machine Learning: Regression and Classification* — *Dec. 2019*

Selected Conferences

2025 AGU Chapman Meeting — Melbourne, AUS
Oral: *Current Continuity in Auroral System Science: Data-Driven Auroral GEMINI 3D Simulation*

2024 AGU Fall Meeting — Washington, DC
Oral: *Current Continuity in Auroral System Science: 3D Data-Driven Auroral GEMINI Simulation*

2024 CEDAR Workshop — San Diego, CA
Poster: *Current Continuity in Auroral System Science: Data-Driven Auroral GEMINI Simulations*

2023 AGU Fall Meeting — San Francisco, CA
Poster: *Current Continuity in Auroral System Science: Defining a Catalog of Auroral GEMINI Simulations*

2023 CEDAR Workshop — San Diego, CA
Poster: *Current Continuity in Auroral System Science: Defining Electron Precipitation*

2022 AGU Fall Meeting — Chicago, IL
Poster: *Auroral System Science: Determining Geophysical Boundary Conditions for Multi-fluid Volumetric Simulations of Auroral Arcs*

2022 CEDAR Workshop — Austin, TX
Oral: *Two Threads for 3D Auroral Modeling: How to Drive and How to See*
Poster: *Auroral System Science: Multi-fluid 3D GEMINI Simulations of Auroral Arc Ionospheric Current Closure*

2021 AGU Fall Meeting — Virtual
Oral: *The Effect of Hall Conductance Gradients on Field-Aligned Currents in Non-Sheet-Like Auroral Arcs*

Personal Interests

Analog Photography: Experimenting with film photography, including developing negative film

Coding projects: E.g. personal finance tool for organizing transactions and generating reports, PyTorch based convolutional, sequential neural network model for denoising

Website design: Developed my personal website to display my personal and professional endeavors and to add HTML, CSS, and JavaScript to my repertoire of coding languages

Traveling: I am always happy to travel and explore; from Melbourne, Australia to Ny-Ålesund, Svalbard