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 instrument testing. Driven by intellectual curiosity, I actively cultivate diverse strengths. Fundamentally, I am *curious*, *conscientious*, and *interdisciplinary*.

Education

Dartmouth College — Hanover, NH
Doctor of Philosophy in Physics — *Since Sep. 2019*

University of Calgary — Calgary, AB
Bachelor of Science (Honours), Major in Astrophysics — *Sep. 2014 – June 2018*

Southern Alberta Institute of Technology — Calgary, AB
Mechanical Eng. Tech. (Honours), Major in Design and Development — *Sep. 2012 – June 2014*

Professional Experience

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

- Approved thesis proposal on electric current closure in atmospheric plasmas. Defense: July 2025
- Proposed, and selected for graduate funding from, NASA's 2022 FINESST solicitation
- Aided in developing NASA's 2022 HLCAS selected proposal: *Geophysical Non-Equilibrium Ionospheric System Science* (GNEISS, PI: K. A. Lynch) sounding rocket mission
- Aided in developing NASA's 2019 MIDEX proposal and 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
- Teaching Assistantship for both graduate and undergraduate classes, and mentoring of undergraduate students in the Lynch research group

Instrument Design and 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) 2 sounding rocket mission

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

– Used the European Space Agency's Swarm EFI data for 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 Group of Companies – T. Russell – 403 700 5355 *May 2014 – Oct. 2014*

– Designed a bearing removal tool prototype used in servicing vertical shock absorbers for Measurements While Drilling (MWD) technology

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, generate/manage yearly budgets and reimbursements *Since Feb. 2024*

Department Building Committee Liaison Dartmouth College
Restore and refurnish community spaces, Reorganizing and redesigning office spaces *Since Oct. 2024*

Publications

– van Irsel, J., Lynch, K., Mule, A., Zettergren, M., Burchill, J., (2025), Data-Driven 3D Simulations of Auroral Arc Systems, *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 E* and *D*.

– van Irsel, J., Burchill, J., Knudsen, D., Buchert, S., (2023), Local, small scale, highly correlated ion upflows and electron temperatures in the high latitude topside ionosphere, *Journal of Geophysical Research: Space Physics*. Manuscript in preparation.

Awards & Scholarships

NASA FINESST: Future Investigators in NASA Earth and Space Science and Technology 2022

NSERC USRA: Undergraduate Student Research Award (Declined) 2018

PURE Award: Program for Undergraduate Research Experience Award 2017

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*

2021 CEDAR Workshop Meeting Virtual
Poster: *FAC Contributions from Hall Conductance Gradients in Non-Sheet-Like Auroral Arcs*

2020 CEDAR Workshop Virtual
Poster: *Auroral Ionosphere: Combining Swarm Ion Flows and THEMIS Imagery with Machine Learning*

2017 AGU Fall Meeting New Orleans, LA
Poster: *Multi-scale investigation of low-altitude ion upflow and electron temperature correlations in the cusp/cleft ionosphere*

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, multi-threading, Slurm Workload Manager, Portable Batch System

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

Personal Interests

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

Coding projects: E.g. a personal finance tool for organizing transactions and generating reports

Website design: I have enjoyed learning HTML, CSS, and JavaScript to build my website from scratch

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