# Jules van Irsel

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## Professional Summary

Graduate student adept in mechanical and electrical computer aided design, engineering, manufacturing, and testing. Proficient in the core branches of physics, multilingual computational physics, and large data management. Fundamentally, I have endless intellectual curiosity which enables me to have diverse strengths. I am *curious*, *conscientious*, and *interdisciplinary*.

## Education

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

**University of Calgary** — Calgary, AB
*Bachelor of Science (Honours), Major in Astrophysics, 4.00* — *Sep. 2014 – June 2018*

**Southern Alberta Institute of Technology** — Calgary, AB
*Mechanical Eng. Tech. (Honours), Major in Design and Development, 4.00* — *Sep. 2012 – June 2014*

## Professional Experience

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

- Approved thesis proposal: *Current Continuity in Auroral System Science: A 3D Modelling Approach to Current Closure in Non-Sheetlike Auroral Arcs*: Expected defense: May 2025
- Proposed, and selected for graduate funding from, NASA's ROSES-2022 FINESST solicitation: *Current Continuity in Auroral System Science: A 3D Modelling Approach to Current Closure in Non-Sheetlike Auroral Arcs*
- Aided in developing NASA's ROSES-2022 HLCAS proposal: *Geophysical Non-Equilibrium Ionospheric System Science* (GNEISS, PI: K. A. Lynch) sounding rocket mission
- Aided in developing NASA's MIDEX-2019 proposal and through its Phase A Concept Study Report: *Auroral Reconstruction CubeSwarm* (ARCS, PI: K. A. Lynch)
- Produced a catalog of multifluid 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 data products, as well as visualizing the resulting rich output data volumes (github.com/317lab/aurora_gemini)
- Vacuum/plasma tested and wrote the GSE software for Petite Ion Probes and oversaw their integration onto NASA's *Loss through Auroral Microburst Pulsations* (LAMP, PI: A. Halford) sounding rocket

**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 electron baffling
- Assisted in rMPI environment testing (vacuum, vibration, plasma, etc.) and oversaw its integration onto NASA's *Cusp-Region EXperiment 2* (C-REX 2, PI: M. Conde) sounding rocket
- Oversaw integration of rMPIs onto NASA's *VISualizing Ion Outflow via Neutral atom Sensing 2* (VISIONS 2, PI: D. Rowland) 2 sounding rocket

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

– Research project on ionospheric upflow in the topside F-Region

– Used ESA's Swarm's EFI data to perform a superposed epoch analysis using electron temperature enhancements (as a probe for electron precipitation) and ion vertical flow

**Mechanical Design Engineer & MWD Technician** Calgary, AB
*QCD Group of Companies – T. Russell – (403) 700 5355* *May 2014 – Oct. 2014*

– Assembled, maintained, and serviced vertical shock absorbers used in Measurements While Drilling (MWD) technology

– Designed a first prototype of a bearing removal tool used in servicing the shock absorber

## Publications

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

– Lynch, K. A., 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*. Manuscript in prep.

## Courses

**ISR Summer School** Virtual
Theory, concepts, and hands-on experiment design for incoherent scatter radars *Jul. 2020*

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

## Conferences

**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 Multifluid Volumetric Simulations of Auroral Arcs*

**2022 CEDAR Workshop** Austin, TX
Oral: *Two Threads for 3D Auroral Modelling: How to Drive and How to See*
Poster: *Auroral System Science: Multifluid 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 ionoshphere*

**Fourth Swarm Science Meeting** Banff, AB
Volunteering opportunity

## 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

**Skills Alberta**: 4th place in Mechanical Computer Aided Design and Drafting 2012

## Technical Skills

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

**Programming Languages**: Python, MATLAB, Mathematica, Fortran, HTML/CSS, 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