Mykhaylo Shumko

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https://mshumko.github.io

EDUCATION

Montana State University *August 2014 - April 2020*
Ph.D. in Physics
Dissertation topic: Connecting Microburst Precipitation to Its Scattering Mechanism
https://mshumko.github.io/files/shumko_dissertation.pdf

University of California, Santa Cruz *September 2010 - June 2014*
B.S. in Astrophysics.
Thesis topic: Dynamic studies of punch thorough protection of silicon strip detectors with laser-based charge injection system.
https://mshumko.github.io/files/shumko_thesis.pdf

EXPERIENCE

Dartmouth College September 2022 - December 2022
Lecturer *Hanover, NH*

- Taught the undergraduate Plasma Physics Course
- Advised a graduate student
- Developing a physics-informed neural network.

University of Maryland May 2022 - present
Post-Doctoral Associate *College Park, MD*

- identifying the wave-derivers of pulsating aurora and relativistic electron precipitation using the THEMIS ASIs, THEMIS satellites, and the SAMPEX satellite.
- Advised a graduate student
- Developing the LAMPsat CubeSat mission concept.
- Developed the sampex (`https://sampex.readthedocs.io/`) python package to download, load, and plot the SAMPEX satellite data. This package includes a simple user interface, through documentation with examples, automatic tests, and minimal dependencies.

NASA's Goddard Space Flight Center May 2020 - May 2022
NASA Postdoctoral Program (NPP) Fellow *Greenbelt, MD*

- Provided microburst physics expertise and now analyzing all-sky imager data for the Loss through Auroral Microburst Pulsations (LAMP) sounding rocket mission
- Leading the LAMPsat CubeSat mission concept. This CubeSat will contain an imager and two particle detectors to directly observe the concurrency of radiation belt precipitation and the aurora.
- Interviewed for the Relatively Cosmic podcast.
- Developing aurora-asi-lib, a Python package that easily downloads, plots, animates, and analyzes auroral all sky imager (ASI) data (`https://aurora-asi-lib.readthedocs.io/`)

- Writing the data processing pipeline for the upcoming Geostationary Transfer Orbit Satellite (GTOsat) mission
- Published studies to understand under what conditions is the low-energy auroral precipitation observed by the THEMIS imagers was associated with relativistic electrons observed by the SAMPEX satellite
- Published studies on multi-point observations of electron curtain and microburst precipitation observed by the AeroCube-6 CubeSats
- Published a study on the duration of electron microbursts observed by NASA's SAMPEX mission
- Advised a summer student

Space Sciences and Engineering Laboratory September 2014 - April 2020
Graduate Research Assistant and Postdoctoral researcher *Bozeman, MT*

- Assisted with the launch of a BARREL high altitude balloon out of McMurdo, Antarctica in December 2019
- Operated the FIREBIRD-II CubeSats and developed the data pipeline to automatically process and upload new data to `http://solar.physics.montana.edu/FIREBIRD_II`
- Organized and led a Particle Precipitation Workshop at University of New Hampshire, April 17th-18th, 2019
- Use Two Line Elements to generate ephemeris and IRBEM-Lib to generate magnetic ephemeris for FIREBIRD-II
- Created a detection algorithm to identify transient and spatial features observed by the AeroCube-6 multi-spacecraft CubeSat mission
- Developed a Python wrapper for IRBEM-Lib: `https://github.com/PRBEM/IRBEM`
- Created a database of microbursts observed with the FIREBIRD-II CubeSats, detected using a wavelet filtering and reconstruction
- Advised REU and undergraduate students
- Programmed a Long Range (LoRa) Arduino software-defined radio to transmit data from remote locations with a low power consumption
- Programmed an HCS08 microcontroller in assembly to control a thermoelectric cooler
- Co-directed the Rocky Mountain Data Science Club

Los Alamos National Laboratory June - July 2018
Summer student *Los Alamos, NM*

- Performed a sensitivity analysis of the Magnetic Electron Ion Spectrometer on the Van Allen Probes
- Developed a forward model to convert a flux energy spectra to count rates observed by the Magnetic Electron Ion Spectrometer and optimized the model parameters using a Markov chain Monte Carlo sampler

The Aerospace Corporation May - August 2017
Graduate Intern *El Segundo, CA*

- Analyzed a microburst observed by the Van Allen Probes and used resonant diffusion theory to conclude that the electron transport is inconsistent with particle transport along single-wave characteristics (diffusion curves for monochromatic waves)
- Estimated the magnetic field model footpoint error for a variety of magnetic field models using IRBEM-Lib

Santa Cruz Institute for Particle Physics September 2012 - August 2014
Student Researcher *Santa Cruz, CA*

- Tested Punch-Through Protection resistance and safe operating voltage of Low Resistance silicon strip detectors in silicon sensor Laboratory using DC voltage sweep

- Learned how to carefully transport, cool, bias, and probe ATLAS strip silicon detectors under a microscope.
- Performed laser injection studies to determine the detector tolerance to large injected charges from beam losses.
- Captured a charge pulse on an oscilloscope and used ROOT, a C++ interpreter, to process measured pulses.

Big Bear Solar Observatory Summers of 2011, 2012, and 2013
Programmer & Researcher *Big Bear, CA*

- Analysed the performance of the PCO-EDGE Camera using IDL software to quantify non-linearity in intensity, readout noise and gain with a photon transfer curve, and fixed-pattern noise by image inspection

PUBLICATIONS

- Coauthor (submitted), Spatial and storm-time dependence of electron microburst pitch angle isotropy
- Author, Proton aurora and relativistic electron microbursts scattered by electromagnetic ion cyclotron waves. (2022) Front. Astron. Space Sci. https://doi.org/10.3389/fspas.2022.975123
- Author, AuroraX, PyAuroraX, and aurora-asi-lib: a user-friendly auroral all-sky imager analysis framework. (2022) Front. Astron. Space Sci. https://doi.org/10.3389/fspas.2022.1009450
- Coauthor, Quantifying the size and duration of a microburst-producing chorus region on 5 December 2017. (2022) Geophysical Research Letters, 49, e2022GL099655 https://doi.org/10.1029/2022GL099655
- Author, Duration of individual relativistic electron microbursts: A probe into their scattering mechanism. (2021) Geophysical Research Letters, 48, e2021GL093879. https://doi.org/10.1029/2021GL093879
- Author, A strong correlation between relativistic electron microbursts and patchy aurora. (2021) Geophysical Research Letters, 48, e2021GL094696. https://doi.org/10.1029/2021GL094696
- Coauthor, The Energy Spectra of Electron Microbursts Between 200 keV and 1 MeV. (2021) Journal of Geophysical Research: Space Physics, 126, e2021JA029709. https://doi.org/10.1029/2021JA029709
- Coauthor, Energetic Electron Precipitation Observed by FIREBIRD-II Potentially Driven by EMIC Waves: Location, Extent, and Energy Range From a Multievent Analysis. Geophysical Research Letters, 48(5), e2020GL091564.
- Coauthor, Estimating the Impacts of Radiation Belt Electrons on Atmospheric Chemistry Using FIREBIRD II and Van Allen Probes Observations. Journal of Geophysical Research: Atmospheres, 126(7), e2020JD033098.
- Author, Statistical Properties of Electron Curtain Precipitation Estimated with AeroCube-6, published in Journal of Geophysical Research, November 2020. (DOI:10.1029/2020JA028462)
- Author, Electron Microburst Size Distribution Derived with AeroCube-6, published in Journal of Geophysical Research, February 2020. (DOI:10.1029/2019JA027651)
- Coauthor, The FIREBIRD-II CubeSat Mission: Focused Investigations of Relativistic Electron Burst Intensity, Range, and Dynamics, accepted in Review of Scientific Instruments, February 2019.
- Coauthor, Direct Observation of Sub-Relativistic Electron Precipitation Driven by EMIC Waves, published in Geophysical Research Letters, November 2019 (DOI: 10.1029/2019GL084202)
- Author, Evidence of Microbursts Observed Near the Equatorial Plane in the Outer Van Allen Radiation Belt, published in Geophysical Research Letters, July 2018 (DOI: 10.1029/2018GL078451)
- Author, Microburst Scale Size Derived from a Bouncing Packet Microburst Simultaneously Observed with the FIREBIRD-II CubeSats, published in Geophysical Research Letters, July 2018 (DOI: 10.1029/2018GL078925)

- Coauthor, Observations directly linking relativistic electron microbursts to whistler mode chorus: Van Allen Probes and FIREBIRD II, published in Geophysical Research Letters, November 2017 (DOI: 10.1002/2017GL075001)
- CoAuthor, Low-Resistance Strip Sensors for Beam-Loss Event Protection, published in November 2014. (DOI: 10.1016/j.nima.2014.05.089)

AWARDS

- NASA Goddard Diversity and Inclusion Award, 2021
- Heliophysics Supporting Research Grant, 2021
- Internal Scientist Funding Model Grant at Goddard Space Flight Center, 2021
- NASA Postdoctoral Program Fellowship, 2020
- NASA Earth and Space Sciences Fellowship, 2018, 2019
- Vela Fellowship, 2018
- The Best Inner Magnetosphere Poster, GEM Workshop, 2016
- Montana Space Grant Consortium Fellowship, 2015 - 2016
- NASA EPSCoR Travel Grant, 2015

CONFERENCES, MEETINGS, AND WORKSHOPS

- Member of an ISSI team, Dynamics of Electromagnetic Ion Cyclotron Wave Activity in the Earth's Magnetosphere, 2021-present
- Gave a talk and Co-convened an oral session, AGU Fall Meeting, 2021
- Gave a talk and presented a poster, GEM Workshop, 2021
- Invited talk, CEDAR workshop, 2021
- Gave a talk, AGU Fall Meeting, 2020
- Gave a talk, Goddard's Early Career Scientist Forum, 2020
- Give a talk, Directors' Seminar, 2020
- Gave a talk, GEM workshop, 2020
- Poster presenter, AGU Fall Meeting, 2019
- Invited focus group talk and poster presenter, GEM workshop, 2019
- Poster presenter, AGU Fall Meeting, 2018
- Gave a student tutorial, focus group speaker, and poster presenter, GEM workshop, 2018
- Speaker, AGU Fall Meeting, 2017
- Speaker, Relativity and Astrophysics Seminar, MSU, 2017
- Invited speaker, Space Sciences Lab, UC Berkeley, 2017
- Gave a student tutorial, focus group speaker, and poster presenter, GEM workshop, 2017
- Poster presenter, AGU Fall Meeting, 2016
- Student, CISM Space Weather Summer School, 2016
- Poster presenter, GEM Workshop, 2016
- Speaker, MSGC Research Symposium, 2016
- Speaker, Van Allen Probe ECT Teem Meeting, 2015
- Poster presenter, CEDAR Workshop, 2015

SERVICE

· Served on NASA review panels as a Reviewer and Executive Secretary.
· Reviewed for AGU Books as well as AGU's JGR and GRL journals.

TEACHING EXPERIENCE

· Instructor, Physics 68, Plasma Physics, Fall 2022
· Teaching Assistant, Physics 220, Intro to Physics I (w/ calculus), Spring 2016
· Instructor, Physics 201, Physics by Inquiry, Fall 2015
· Teaching Assistant, Physics 207, Intro to Physics II, Spring 2015, Summer 2015
· Teaching Assistant, Physics 205, Intro to Physics I, Fall 2014

TECHNICAL STRENGTHS

Computer Languages	Python, C and Assembly
Protocols	git, and SSH
Tools	LaTeX, VS Code, Inkscape, WSL, Technician ham radio license
Languages	English and Russian

OTHER EMPLOYMENT EXPERIENCE

· Student Manager, UC Santa Cruz Cowell/Stevenson Dining Hall. September 2010 - May 2014
· Bike Mechanic, UC Santa Cruz Bike Maintenance Clinic. April 2012 - June 2014