

Mykhaylo Shumko

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mshumko.github.io

EDUCATION

Montana State University

August 2014 - April 2020

Masters in Physics

Awarded in May 2016

Ph.D. in Physics

Awarded in December 2019

Dissertation topic: Connecting Microburst Precipitation to Its Scattering Mechanism

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.

mshumko.github.io/files/shumko_thesis.pdf

EXPERIENCE

NASA's Goddard Space Flight Center

May 2020 - present

NASA Postdoctoral Program (NPP) Fellow

Greenbelt, MD

- Developed 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/>). Learned and implemented: packaging a set of Python modules, downloading a large volume of data, writing HTML documentation using Sphinx, automatically running tests using GitHub Actions, and archiving the package on PyPI. Install package as easy as “python3 -m pip install aurora-asi-lib”
- Writing the data processing pipeline for the upcoming NASA's GTOsat mission. Researched and implemented: how to load and process binary data packets, how to check for valid packets, test the pipeline using Python's unittest module, and organize the processing code into a dependency-resolved package to be easily shared with other GTOsat scientists
- Analyzed and published a study that used multi-spacecraft measurements to resolve the spatiotemporal ambiguity with fast-moving satellites and identify curtain electron precipitation
- Studies electron curtain precipitation and published a paper on it's statistical properties
- Studied the duration property of electron microbursts observed by NASA's SAMPEX mission.

Space Sciences and Engineering Laboratory

September 2014 - April 2020

Graduate Research Assistant and Postdoctoral researcher

Bozeman, MT

- Launched the BARREL high altitude balloon out of McMurdo, Antarctica, December 2019
- Operate the FIREBIRD-II CubeSats and developed the data pipeline to automatically process and upload new data to the internet within 24 hours. Data is located at 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

- Developed a conjunction toolkit, a software package for calculating magnetic conjunctions between spacecraft. Lists of past conjunctions are used for analysis, and future conjunctions to prioritize FIREBIRD-II CubeSat data downlinks
- 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://sourceforge.net/p/irbem/code/HEAD/tree/trunk/python/>
- 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-director of the Rocky Mountain Data Science Club <https://rmds.tech/>

Los Alamos National Laboratory

Summer student

June - July 2018

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

Graduate Intern

May - August 2017

El Segundo, CA

- Analyzed a microburst observed by the Van Allen Probes and used resonant diffusion theory to conclude that the electron transport is not consistent with particle transport along single-wave characteristics (diffusion curves for monochromatic waves)
- Estimated the magnetic field model footprint error for a variety of magnetic field models with IRBEM-Lib

Santa Cruz Institute for Particle Physics

Student Researcher

September 2012 - August 2014

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
- Performed laser injection studies on the ATLAS strip detectors to determine sensor tolerance to large injected charges from beam losses. Used ROOT, a C++ interpreter, to process measured waveforms

Big Bear Solar Observatory

Programmer & Researcher

Summers of 2011, 2012, and 2013

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

- Author, Duration of Individual Relativistic Electron Microbursts: A Probe Into Their Scattering Mechanism, Geophysical Research Letters, 48, e2021GL093879. <https://doi.org/10.1029/2021GL093879>
- Author, On the Unexpected Correlation Between Relativistic Electron Microbursts and Patchy Pulsating Aurora, Geophysical Research Letters, 48, e2021GL094696. <https://doi.org/10.1029/2021GL094696>

- Coauthor, The Energy Spectra of Electron Microbursts Between 200 keV and 1 MeV, submitted to JGR: Space Physics (2021)
- Coauthor, Energetic Electron Precipitation Observed by FIREBIRDII 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

- Gave a talk and presented a poster, GEM Workshop, 2021
- Invited talk, CEDAR workshop, 2021
- Reviewer, NASA Review Panel, 2021
- Executive Secretary, NASA Review Panel, 2014, 2018, 2021
- Gave a talk, AGU Fall Meeting, December 2020
- Gave a talk, Goddard's Early Career Scientist Forum, November 2020

- Give a talk, Directors' Seminar, September 2020
- Gave a talk, GEM workshop, July 2020
- Poster presenter, AGU Fall Meeting, Dec 2019
- Invited focus group talk and poster presenter, GEM workshop, June 2019
- Poster presenter, AGU Fall Meeting, Dec 2018
- Executive Secretary, NASA Review Panel, 2014, 2018
- Gave a student tutorial, focus group speaker, and poster presenter, GEM workshop, June 2018
- Speaker, AGU Fall Meeting, Dec 2017
- Speaker, Relativity and Astrophysics Seminar, MSU, Sept 2017
- Invited speaker, Space Sciences Lab, UC Berkeley, Aug 2017
- Gave a student tutorial, focus group speaker, and poster presenter, GEM workshop, June 2017
- Poster presenter, AGU Fall Meeting, Dec 2016
- Student, CISM Space Weather Summer School, July 2016
- Poster presenter, GEM Workshop, June 2016
- Speaker, MSGC Research Symposium, April 2016
- Speaker, Van Allen Probe ECT Team Meeting, September 2015
- Poster presenter, CEDAR Workshop, June 2015

TEACHING EXPERIENCE

- 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, SSH and Samba Share
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