

Education

Ph.D., Applied Physics

New Jersey Institute of Technology & Rutgers University, Newark, NJ

Dissertation: The Hydromagnetic Structure of the Polar Cap and Its Interaction with the Solar Wind

M.S., Applied Physics (Minor: Applied Mathematics)

New Jersey Institute of Technology & Rutgers

University, Newark, NJ

Thesis: Synoptic Variability of a CIR-Driven Open-Closed Boundary During Solar Minimum

B.S., Applied Physics (Minor: Applied Mathematics)

New Jersey Institute of Technology & Rutgers

University, Newark, NJ

Computing Skills

Programming / Tools: Proficient in Python (Jupyter, TensorFlow-GPU, Keras, SciKit-Learn, Pandas, NumPy, Requests, BeautifulSoup, Selenium), R (dplyr, tidyr, ggplot2, magrittr, RStudio, R Markdown, etc), SQL (PostgreSQL, SQLite), Amazon Web Services (Redshift, S3, EC2, EBS), Tableau, MatLab, Octave, IDL, UNIX (OS X) and Linux (Ubuntu) Shell Scripting (e.g., bash, awk, sed, grep, wget, ssh, sftp, etc), Git, Github, LaTeX, Vim, HTML, CSS, javascript, Markdown, Excel, Google Sheets; Limited Experience and/or Classroom exposure to Spark, Hive, Java, C/C++, Fortran

Analytics:

- **Structured & Unstructured Data** (e.g., sensors, scientific instrumentation, spacecraft, images, text, time series, geospatial, simulation, genomics, marketing, viewership, commerce, webpages, social media)
- **Data Pre-Processing** (e.g., table joins, up/down sampling, outlier detection, imputation, aggregation, feature selection / engineering / extraction, regex and rules-based scrubbing / transformations)
- **Probability & Statistics** (e.g., inference, hypothesis testing, resampling, conditioning, error analysis)
- **Machine Learning** (e.g., neural networks, deep learning, CNNs, RNNs, reinforcement learning, statistical models, regression, classification, clustering, prediction, PCA, LDA, decision trees, random forests, sentiment analysis, natural language processing)
- **Time Series Analysis** (e.g., parametric, nonparametric, spectral analysis, digital signal processing, digital filtering, forecasting, wavelets)
- **Numerical Modeling** (e.g., difference equations, numerical derivatives, numerical integration, linear/nonlinear models, dynamical systems, numerical stability, eigenvalue estimation)

Work and Professional Research Experience

WWE, Advanced Analytics Team

Stamford, CT • October 2016 – Present

Data Scientist

- Lead on numerous business-driven analytics research and predictive modeling projects for WWE Network – an over-the-top (OTT) content distribution network that can be described as “Netflix for Wrestling” and currently supports nearly 2 million active users, generating 1-3 million new rows of viewership/behavioral data in Redshift database every day
- Experimentation and development of machine learning pipelines in Python / Scikit-Learn (preprocessing, feature selection, dimensionality reduction) and deep neural network models in Keras and TensorFlow on AWS EC2 x2.2xlarge (GPU instance) for a handful of projects related customer segmentation, churn, and lifetime value (multilayer perceptrons, autoencoders, recurrent neural networks)
- Development of wrestler image recognition algorithm (transfer learning, convolutional neural networks)
- Spectral analyses of customer churn/winback behaviors to enhance customer segmentation efforts, help advise email campaigns, and improve churn/winback forecasting
- Development of ensemble approach to revenue attribution models for WWE Network content driven by viewership behaviour at the customer level (analysis of over a billion rows of data in Redshift)
- Fusion of fan panel / survey response data with customer accounts on the WWE Network to better quantify the relationship between subjective responses and objective viewership data
- Natural language processing (sentiment analysis) of customer cancellation surveys and social media content to uncover resolvable issues and inform on how to better serve our customer base
- Automation of report generation and analytic work flows through the development of project-agnostic and project-specific R packages and python scripts (data extraction, cleansing, transformation, analysis, reporting, website scraping)
- Decision tree analyses to help understand and segment customers by WWE content and character preferences
- Design of interactive dashboards in Tableau to help interested parties explore our data assets

NJIT Center for Solar-Terrestrial Research**Newark, NJ • January 2012 – May 2016***Research Scientist*

- Fusion and harmonization of data sets from a ground-based, globally-distributed network of instruments; high-altitude satellites, such as NOAA's DMSP fleet and NASA's Van Allen Probes; and interplanetary spacecraft (NASA's ACE)
- Provided new, empirical insights and interpretation of decades-old problem concerning the geomagnetic field's complex structure in Earth's polar regions
- Developed prediction scheme to forecast intensity and spatial-temporal distribution the magnetic weather in Earth's deep polar cap region using spacecraft upstream of Earth in the solar wind (NASA's ACE)
- Inverted the prediction scheme to leverage it as a remote-sensing technique such that data from ground-based magnetometers in Antarctica can be used to infer space weather parameters in near-Earth space and, if necessary, could essentially replace in-situ spacecraft for certain measurements
- Created innovative visualization and analysis techniques to better understand and transform our understanding of the Earth magnetic geography and its dynamic response to varying space weather conditions
- Supported myriad data analysis efforts and projects as a member of the RBSPICE instrument team for NASA's Van Allen Probes mission, which has been essential in understanding and forecasting hazardous conditions of Earth's radiation belt environment
- Developed software packages in Bash, R, MatLab, and IDL to enable efficient, streamlined analyses and reporting for a range of ongoing projects
- Published first-author publication, PhD dissertation, and currently have several papers in development

NJIT Department of Mathematical Sciences**Newark, NJ • 2008 – 2012***Research Scientist, Mathematical Modeling*

- Developed dynamical system models for granular fluid systems
- Simulated and visualized the dynamical models in MatLab and R
- Investigated sources of chaos and instability in such systems by projecting them into a dimensionally-reduced parameter space and coding simulations of their Poincare maps in R
- Led effort in understanding and controlling the propagation of numerical errors, which otherwise prevent proper quantitative analysis and visualization of the underlying dynamical system
- Co-authored four peer-reviewed papers numerically modeling, visualizing, and analyzing granular fluid systems
- Led research on potential engineering applications of fractional calculus and co-authored peer-reviewed publication
- Explored real-world applications of advanced mathematical disciplines such as dynamical systems, topological analysis, manifold theory, abstract algebra, stochastic calculus

NASA/CalTech Jet Propulsion Laboratory**Pasadena, CA • Summer 2011***Intern, Trajectory Optimization / Design*

- Collaborated with a team of engineers and scientists to develop a full-fledged spacecraft mission to the Trojan asteroids of Jupiter (from establishing and prioritizing science goals, to optimizing the science-engineering-financial parameter space, to the written proposal and presenting our mission design to the NASA review board)
- Gained an appreciation of rapid product development via concurrent engineering, and an understanding of the intricate interplay between the various engineering system designs, science goals, timeline requirements, and budget constraints.
- Published peer-reviewed paper documenting lessons learned

Independent Research Consultant**Clifton, NJ • August 2010 - January 2012**

- Procured contracts from NJIT's Physics Department and Siena College's Department of Physics and Astronomy to continue the development of automated, real-time prediction of geomagnetic parameters using geospatially-distributed network of magnetometers
- Published peer-reviewed paper documenting proof-of-concept and lessons learned proof-of-concept ^[link]

NJIT Department of Physics**Newark, NJ • August 2008 - August 2010***Research Assistant*

- Led project demonstrating the feasibility of a real-time surveillance, detection, classification, and prediction of local, regional, and global-scale geomagnetic events of interest
- Analyzed multi-channel instrument data from a spatially-distributed network of automated observatories in Antarctica.
- Developed data metrics and associated classification scheme for events of interest in the data sets.
- In-depth experience visualizing and analyzing data in R, MatLab, and IDL
- In-depth experience in various data analysis techniques, such as digital signal processing, time series analysis, spectral analysis, statistical methods, modeling, and regression.
- Hardware-software interfacing of instrumentation for data collection
- Published Master's thesis

Center for Solar-Terrestrial Research, NJIT**Newark, NJ • January – August 2008***Intern*

- Developed software to interface instrument sensors with an analog-to-digital converter
- Collected and managed digitized instrument data
- Created real-time visualization software (MatLab) for continuous data display at local museum in Jenny Jump State Park

NASA Goddard Space Flight Center

Greenbelt, MD • June – August 2007

Intern, Observational Cosmology Laboratory

- Developed software implementing a Stokes parameter analysis to run on simulation data for the proposed Absolute Spectrum Polarimeter [ASP] — an instrument designed to detect B-mode gravitational waves, which would provide evidence for Einstein’s theory of general relativity and cosmological inflationary theory
- Worked with multiple programming languages, including MatLab, Bash (shell scripting), and IDL

NASA Goddard Space Flight Center

Greenbelt, MD • June – August 2006

Intern, Heliophysics Division

- Worked extensively in the UNIX programming environment, learning and developing Python, HTML, CSS, JavaScript, and PHP code
- Developed web content

Peer-Reviewed Papers

- Urban, K. D., A. J. Gerrard, L. J. Lanzerotti, and A. T. Weatherwax, Rethinking the polar cap: Eccentric-dipole structuring of ULF power at the highest corrected geomagnetic latitudes, *Journal of Geophysical Research, Space Physics*, Vol. 121, 2016.
- Urban, Kevin, The hydromagnetic structure of the polar cap and its interaction with the solar wind. PhD Dissertation. New Jersey Institute of Technology / Rutgers University, Department of Physics, 2016.
- Blackmore, D., A. Rosato, X. Tricoche, K. D. Urban, and L. Zou, Analysis, simulation, and visualization of 1D tapping via reduced dynamical models ^[link]. *Physica D: Nonlinear Phenomena*, Vol. 273, 2014.
- Diniega, S., K. Sayanagi, J. Balcerski, B. Carande, R. Diaz-Silva, A. Fraeman, S. Guzewich, J. Hudson, A. Nahm, S. Potter, M. Route, K. D. Urban, S. Vasisht, B. Benneke, S. Gil, R. Livi, B. Williams, and C. Budney, L. Lowes, Mission to the Trojan Asteroids: lessons learned during a JPL Planetary Science Summer School mission design exercise ^[link], *Planetary and Space Science*, Vol. 76, 2013.
- Rosato, A., D. Blackmore, X. M. Tricoche, K. D. Urban, and L. Zuo, Dynamical systems model and discrete element simulations of a tapped granular column ^[link]. *Powders and Grains 2013: Proceedings of the 7th International Conference on Micromechanics of Granular Media*. Vol. 1542. No. 1. AIP Publishing, 2013.
- Urban, K. D., Y. Bhattacharya, A. J. Gerrard, A. Ridley, L. Lanzerotti, and A. Weatherwax, Quiet-time observations of the open-closed boundary prior to the CIR-induced storm of August 9, 2008 ^[link]. *Space Weather*, Vol. 9, S11001, 2011.
- Blackmore, D., A. Rosato, X. Tricoche, K. Urban, and V. Ratnaswamy, Tapping dynamics for a column of particles and beyond ^[link]. *Journal of Mechanics of Materials and Structures*, Vol. 6, No. 1-4, 2011.
- Urban, Kevin, Synoptic Variability of a CIR-driven Open-closed Boundary During Solar Minimum. Master’s Thesis. New Jersey Institute of Technology / Rutgers University, Department of Physics, 2010.
- Blackmore, D., K. Urban, and A. Rosato, Integrability analysis of regular and fractional Blackmore-Samulyak-Rosato fields ^[link]. *Condensed Matter Physics*, Vol. 13, No. 4, 2010.

Invited Presentations

2015

- Urban, K., A. J. Gerrard, L. J. Lanzerotti, and A. T. Weatherwax, “Quantifying Solar Wind-Polar Cap Interactions,” *American Geophysical Union Fall Meeting*, San Francisco, CA. Dec 14-18, 2015.
- K. Urban, “Sailing the Seas of the Solar Wind,” *Meeting of the North Jersey Astronomical Group*, Montclair State University, Montclair, NJ. Nov. 11, 2015.
- Urban, K., A. J. Gerrard, L. J. Lanzerotti, and A. T. Weatherwax, “Solar Wind-Polar Cap Open Field Interactions ^[link],” Coupling, Energetics, and Dynamics of Atmospheric Regions [CEDAR], 2015 Meeting, Seattle, WA
- Urban, K., “AGO Fluxgate Data: Extracting value from an imperfect time series ^[link],” Air Force Research Laboratory, Albuquerque, NM

2011

- K. Sayanagi, J. Balcerski, B. Carande, R. Diaz-Silva, S. Diniega A. Fraeman, S. Guzewich, J. Hudson, A. Nahm, S. Potter, M. Route, K. Urban, S. Vasisht, B. Benneke, S. Gil, R. Livi, B. Williams, “Trojan ASteroid Tour, Exploration, and Rendezvous: TASTER Mission,” *Jet Propulsion Laboratory*, Pasadena, CA. August 2011.

2008

- Urban, K., and A. Gerrard, “Geomagnetic Research at Jenny Jump: the Magnetic Forecast,” *Meeting of the United Astronomy Clubs of New Jersey*, Jenny Jump State Forest, NJ. July 19, 2008.

Other Presentations

2014

- Urban, K., A. J. Gerrard, L. J. Lanzerotti, A. T. Weatherwax, “Locating the Open-Closed Boundary During the Passage of a Corotating Interaction Region ^[link],” American Geophysical Union [AGU] Fall Meeting, San Francisco, CA. December 15-19, 2014.
- Gerrard, A., L. Lanzerotti, J. Manweiler, J. Bortnik, and K. Urban, “Modulation of Ring Current He-Ions by Bounce-Resonant ULF Waves ^[link],” American Geophysical Union [AGU] Fall Meeting, San Francisco, CA. December 15-19, 2014.
- Urban, K., A. Gerrard, L. Lanzerotti, and A. Weatherwax, “The Fluxgate Open-Closed Boundary,” *Geospace Environment Modelling [GEM] “Mini-GEM” Workshop*, San Francisco, CA. December 14, 2014.
- Urban, K. D., A. J. Gerrard, A. T. Weatherwax, L. J. Lanzerotti, and A. Ridley, “Observations of the open-closed boundary during the passage of a corotating interaction region,” *2014 SCAR Biennial Meeting*, Auckland, New Zealand. August 23 - September 3, 2014.
- Urban, K., A. Gerrard, and L. Lanzerotti, “Open-Closed Boundary Reconstruction: Cooperative Space-borne and Ground-based Methods,” *Geospace Environment Modeling [GEM] Summer Workshop*, Portsmouth, VA. June 15-20, 2014.
- Urban, K., A. J. Gerrard, and L. J. Lanzerotti, “Ground-based ULF observations associated with Zebra Stripe Events ^[link],” *Van Allen Probe Science Working Group – RBSPICE Team Meeting*, March 11, 2014.

2013

- Urban, K., A. J. Gerrard, L. J. Lanzerotti, and D. G. Mitchell, “Solar wind-driven ULF activity in Earth’s inner radiation belt: Effects on trapped electrons ^[link],” *American Geophysical Union Fall Meeting*, San Francisco, CA. December 9-13, 2013.
- Urban, K., A. Gerrard, and L. Lanzerotti, “Ground and spaceborne perspectives of ULF activity in Earth’s radiation belts,” *Geospace Environment Modeling [GEM] Summer Workshop*, Snowmass, CO. June 16-21, 2013.
- Blackmore, D., A. Rosato, X. Tricoche, K. Urban, H. Wu, and L. Zou, “Analysis of a dynamical systems model for granular flow,” *SIAM Conf. on Applications of Dynamical Systems*, Snowbird Resort, Utah. May 18-23, 2013.

2012

- Urban, K., and A. J. Gerrard, “Particle precipitation regimes of the polar cap in the midst of deep geomagnetic quiescence: perspectives from the AGO magnetometer network ^[link],” *American Geophysical Union Fall Meeting*, San Francisco, December 3-7, 2012.
- Teti, A., A. Gerrard, J. Olsztyn, Y. Bhattacharya, G. Jeffer, K. Urban, L. Lanzerotti, and A. Weatherwax, “Ground Sites: Mapping of Solar Wind KHI Periodicities and the Subsequent Generation of Compressional/Breathing Pc5 Modes ^[link],” *American Geophysical Union Fall Meeting*, San Francisco, December 3-7, 2012.
- Nahm, A., S. Potter, KS Sayanagi, S. Diniega, S. Gil, J. Balcerski, B. Carande, R. Diaz-Silva, A. Fraeman, J. Hudson, S. Guzewich, R. Livi, M. Route, K. Urban, S. Vasisht, B. Williams, C. Budney, and L. Lowes, “TASTER: Trojan Asteroid Tour, Exploration, and Rendezvous, a JPL Planetary Science Summer School Mission Design Exercise ^[link],” *Lunar and Planetary Science Conference*. Vol. 43. 2012.

2011

- Bhattacharya, Y., A. Gerrard, K. Urban, L. Lanzerotti, and A. Weatherwax, “Spectral investigation of PC5 oscillations in SWEPAM proton velocities from the ACE spacecraft,” *CEDAR-GEM Joint Workshop*, Santa Fe, NM. June 26 - July 1, 2011.
- Urban, K., A. Gerrard, L. Lanzerotti, Y. Bhattacharya, A. Ridley, and A. Weatherwax, “Synoptic-scale magnetometer observations of the open-closed field line boundary ^[link],” *American Geophysical Union Fall Meeting*, San Francisco, CA. December 5-9, 2011.

- Bhattacharya, Y., A. Gerrard, K. Urban, L. Lanzerotti, and D. Thomson, “Solar p-mode frequency plasma waves in high speed solar wind streams ^[link],” *American Geophysical Union Fall Meeting*, San Francisco, CA. December 5-9, 2011.
- R. Diaz-silva, K. Sayanagi, S. Gil, S. Diniega, J. Balcerski, B. Benneke, B. Carande, A. Fraeman, J. Hudson, S. Guzewich, R. Livi, A. Nahm, S. Potter, M. Route, K. Urban, S. Vasisht, B. Williams, C. Budney, and L. Lowes, “TASTER: Trojan ASteroid Tour, Exploration and Rendezvous, a NASA Planetary Science Summer School Mission Design Exercise ^[link],” *American Geophysical Union Fall Meeting*, San Francisco, CA. December 5-9, 2011.
- Urban, K., Y. Bhattacharya, A. Gerrard, L. Lanzerotti, “ULF periodicities in the solar wind: drivers of magnetospheric ULF ^[link],” *ACE Science Team Meeting*, Applied Physics Laboratory, Johns Hopkins University, Laurel, MD. Nov 1-2, 2011.
- Bhattacharya, Y., K. Urban, A. Gerrard, L. Lanzerotti, A. Weatherwax, and K. Keika, “Synoptic variation of the OCB during CIR-driven events: issues with the Pc5 periodicities in the solar wind?,” *Japan Geoscience Union Meeting*, Chiba, Japan. May 22-27, 2011.
- Bhattacharya, Y., K. Urban, A. Gerrard, L. Lanzerotti, and A. Weatherwax, “Synoptic variation of the OCB during CIR-driven events: issues with the Pc5 periodicities in the solar wind?,” *PENGUIn-AGO Workshop*, Berkeley, CA. March 17-18, 2011.
- Urban, K., Bhattacharya, Y., A. Gerrard, L. Lanzerotti, “Quiet-time observations of the open-closed boundary prior to the CIR-induced storm of August 9, 2008,” *2011 PENGUIn-AGO Workshop*, UC-Berkeley, Berkeley, CA. March 17-18, 2011.

2010

- Urban, K., A. J. Gerrard, A. Ridley, L. Lanzerotti, and A. Weatherwax, “Synoptic Observations of Open-Closed Boundary Variations at Solar Minimum,” *Autonomous Polar Observing Systems Workshop*, Potomac, MD, September 30-October 1, 2010.
- Blackmore, D., A. Rosato, K. Urban, and X. Tricoche, “Tapping Dynamics of Granular Configurations: Theory and Applications,” *Gordon Conference on Granular and Granular-Fluid Flow*, Colby College, Maine, June 20-25, 2010.

2008

- Urban, K., A. Gerrard, N. Hauser, R. Melville, and L. Lanzerotti, “The NJIT-UACNJ-PSU Collaborative: Magnetometer measurements from northwest New Jersey in collaboration with South Pole magnetometer measurements from the PENGUIn-AGO instrumentation ^[link],” *American Geophysical Union 2008 Fall Meeting*, San Francisco, CA. December 2008.

Relevant Coursework

Graduate: Real Analysis, Complex Analysis, Topology, Differentiable Manifolds, Applications of Abstract Algebra, Stochastic Calculus, Radio Astronomy, Stellar Magnetism, Physics of the Magnetosphere/Ionosphere System, Atmospheric Physics, Electrodynamics, Statistical Mechanics, Classical Mechanics, Quantum Mechanics, Quantum Electrodynamics

Undergraduate: Data Reduction, Probability/Statistics, Linear Algebra, Computer Science I-II (Java/C++), Abstract Algebra, Vector Calculus, Differential Equations, Advanced Calculus, Electromagnetism, Thermodynamics, Classical Mechanics, Observational Astronomy, Astronomy, Astrophysics I-II, Quantum Mechanics, Special Relativity, General Relativity

Extracurricular Deep Learning Nanodegree (Udacity), Computer Vision (Udacity), Self-Driving Car Nanodegree (Udacity), DeepLearning.AI (Coursera, A. Ng) Computing for Data Analysis (R) [Coursera, R. Peng], Data Analysis (R) [Coursera, J. Leek], Bioinformatics Algorithms [Coursera, P. Pevzner], Machine Learning [Coursera, A. Ng], Operator Algebras and Conformal Field Theory [Summer School, U. Oregon], Concurrent Engineering [Planetary Science Summer School, Jet Propulsion Laboratory]