JAMES ANDREW (“ANDY”) EDMOND, PH.D.

Space Physics | Machine Learning

mailto:edmondandy795@gmail.com https://github.com/jae1018 Albuquerque, NM

TECHNICAL SKILLS

Languages

Python | Fortran | C/C++ | R | MATLAB | SQL (MySQL, Postgres)

ML/AI

PyTorch | TensorFlow | scikit-learn | Hugging Face Transformers

LLM/Agents

LangChain | LangGraph | CrewAI | Google ADK | N8N | RAG (FAISS)

MLOps/Cloud

Docker | FastAPI | MLflow | W&B | Git | Microsoft Azure

HPC

MPI | OpenMP | SLURM | Linux clusters

Visualization

Tableau | Power BI

EDUCATION

Ph.D., Space Plasma Physics

University of New Hampshire

Aug 2018 – Sep 2024

Thesis: Development of a Layered Unsupervised Classifier of Plasma Regions and a Bootstrap-Ensemble Neural Network Bow Shock Model
Advisor: Prof. Joachim Raeder

B.S., Disc. Applied Mathematics
B.S., Physics

Auburn University

Aug 2013 – Dec 2017

RESEARCH EXPERIENCE

NRC Postdoctoral Research Associate

Air Force Research Laboratory, Albuquerque, NM

Aug 2025 – Present

Advisor: Dr. Banafsheh Ferdousi

- Awarded competitive NRC postdoctoral associateship (National Academies)
- Developing semi-supervised and multi-modal neural network methods to classify distinct plasma regions in ARTEMIS spacecraft data using Self-Organizing Maps and contrastive learning

Postdoctoral Researcher

GFZ Helmholtz Centre for Geosciences, Potsdam, Germany

Jan – July 2025

Advisor: Dr. Dedong Wang

- Developed Python-based Kalman Filter data assimilation routines for radiation belt modeling using VERB with RBSP and ARASE observations

Ph.D. Research

University of New Hampshire

Jan 2019 – Sep 2024

Advisor: Prof. Joachim Raeder

- Developed unsupervised machine learning pipeline for automatic classification and anomaly detection of magnetospheric plasma regions from THEMIS spacecraft data using Self-Organizing Maps and hierarchical clustering techniques
- Published in *JGR: Machine Learning and Computation* (2024)

Undergraduate Research

Auburn University

May 2014 – Dec 2017

Advisor: Prof. Joseph Perez

- Simulated inner magnetosphere and ionosphere dynamics; operated low-pressure experimental equipment for atomic physics experiments

TEACHING

Co-Instructor: Machine Learning for Scientists and Engineers

University of Potsdam

Apr – July 2025

Co-taught mixed undergraduate/graduate course with Dr. Sadaf Shahsavani and Prof. Yuri Shprits covering machine learning methods (traditional ML and deep learning) for scientific applications.

RESEARCH INTERESTS

Building tools to accelerate scientific workflows through machine learning and automation.

Current focus areas:

- Unsupervised & semi-supervised learning for space science
- Integrating LLMs and agents into scientific pipelines
- Generative modeling for sparse magnetospheric datasets

SELECTED PRESENTATIONS

[1] 2023: "Auto-Classification of Magnetospheric Dayside Data using Unsupervised Learning," AGU Fall Meeting, San Francisco, CA. **[Poster]**

[2] 2022: "Unsupervised Clustering of Magnetospheric Dayside Data," AGU Fall Meeting, Chicago, IL. **[Talk]**

[3] 2021: "Using Machine Learning to Create an Empirical Bow Shock Model from THEMIS Data," AGU Fall Meeting, New Orleans, LA. **[Talk]**

[4] 2021: "Resolving Bow Shock Crossings Using Unsupervised Machine Learning," MMS Community Workshop, Waterville Valley, NH. **[Talk]**

[5] 2021: "Magnetospheric Plasma Region Classification from THEMIS Data Using Machine Learning," Virtual Conference on Applications of Statistical Methods and Machine Learning in the Space Sciences, Boulder, CO. **[Talk]**

TRAINING & FELLOWSHIPS

Machine Learning Summer School (MLSS)

Okinawa Institute of Science and Technology

March 2024

Two-week intensive program covering modern machine learning methods and techniques including LLMs, reinforcement learning, algorithmic fairness, distributed ML, and optimal transport.

Los Alamos Space Weather Summer School

Vela Fellowship Recipient

May – July 2023

Mentor: Dr. Steve Morley

Research Topic: Downscaling Methods to Predict Mesoscale Solar Wind Structure

Used statistical downscaling and MCMC methods to reconstruct high-frequency ($<$1 day) solar wind measurements for increasing the accuracy of solar wind-fed magnetosphere models in predicting geomagnetic storms.

Boulder Space Weather Summer School

UCAR/HAO

July 2019

Two-week program with lectures on solar-terrestrial physics paired with hands-on labs using space weather models.

PUBLICATIONS

Published

[1] **Edmond, J.**, Raeder, J., Ferdousi, B., Argall, M., and Innocenti, M. E. (2024). "Clustering of global magnetospheric observations." *Journal of Geophysical Research: Machine Learning and Computation*, 1, e2024JH000221.

[2] Perez, J. D., **Edmond, J.**, Hill, S., Xu, H., Buzulukova, N., Fok, M.-C., Goldstein, J., McComas, D. J., and Valek, P. (2018). "Dynamics of a geomagnetic storm on 7–10 September 2015 as observed by TWINS and simulated by CIMI." *Ann. Geophys.*, 36, 1439–1456.

In Preparation

[3] **Edmond, J.**, et al. "LLMs as agentic classifiers of magnetospheric observations."

[4] **Edmond, J.**, et al. "Retrieval-augmented generation for space physics literature synthesis."

[5] **Edmond, J.**, et al. "ChronoTagger: A GUI for rapid labeling of time-series data for machine learning."