

Benjamin Lawrence Moyer

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PROFESSIONAL SUMMARY

Computational geophysicist and U.S. Department of Energy Computational Science Graduate Fellow specializing in gravity and magnetic field modeling, large-scale Bayesian inverse problems, and error characterization and uncertainty quantification of geophysical data. Develops production-quality, vendor-portable scientific software in Fortran, C/C++, Julia, Python, and MATLAB (CUDA, HIP, SYCL, MPI); principal contribution is a framework for simultaneous, trans-dimensional joint Bayesian inversion of gravity and magnetic anomaly data, demonstrated at billion-parameter (10^{24}) scale on a single consumer GPU with identical source verified across NVIDIA, AMD, and Intel hardware. Applies machine-learning methods to seismic source characterization in nuclear-explosion-monitoring research at Lawrence Livermore National Laboratory. Experienced across the full geophysical data lifecycle, from field acquisition with gravimetric and magnetometric instrumentation through sensor-level error analysis and large-scale probabilistic modeling, in collaborative, secure, multidisciplinary environments. United States citizen; eligible and willing to begin the security clearance process.

EDUCATION

Ph.D. in Geology (in progress; defense expected Spring 2027)

Aug 2022 – Present

University of Maryland, College Park, MD

- Dissertation: “*The Delicate Balance of Error: The Stable and the Underdetermined in Geophysical Inference.*” Advisors: Drs. Vedran Lekić and Nicholas C. Schmerr.
- Selected coursework: High Performance Computing Systems; Systems for Machine Learning; Computational Methods; Seismic Wave Propagation; Observational Geophysics; Advanced Statistical Analysis; Geoscientific Modeling.

M.Sc. in Geology

Aug 2019 – Dec 2021

Wayne State University, Detroit, MI

- Thesis: “*A Novel Trans-Dimensional Bayesian Method for the Inversion of Gravitational and Structural Data.*” Advisor: Dr. Scott A. Burdick.

B.A. in Physics (Minor in Political Science)

Jan 2014 – Aug 2019

Oakland University, Rochester Hills, MI

FELLOWSHIPS AND AWARDS

- **U.S. Department of Energy Computational Science Graduate Fellowship (DOE CSGF), 2023–Present.** Approximately 35 awarded annually across all areas of computational science nationwide.
- Dean’s Fellowship, University of Maryland, 2022–2023.
- Graduate Geology Merit Award, Wayne State University, 2020–2021.

RESEARCH AND APPLIED EXPERIENCE

Computational Science Researcher (DOE CSGF Practicum)

Jun 2026 – Oct 2026

Lawrence Livermore National Laboratory, Livermore, CA

- Modernizing a legacy Fortran physics code for GPU-accelerated, heterogeneous HPC architectures on LLNL’s Corona cluster, sustaining and extending an established modeling capability for next-generation hardware.
- Collaborating with multidisciplinary laboratory teams in a secure computational environment.

Computational Geophysics Researcher (DOE CSGF Practicum)

Jun 2025 – Aug 2025

Lawrence Livermore National Laboratory, Livermore, CA

- Applied statistical and deep-learning methods to quantify uncertainty in seismic source characterization on LLNL’s Dane and Corona clusters, contributing to nuclear-explosion-monitoring research (AGU 2025, “From Waves to Yields”).

Doctoral Researcher

2022 – Present

University of Maryland, College Park, MD

- Lead development of production-quality computational frameworks for simultaneous joint Bayesian inversion of gravity and magnetic data in Fortran, C++, and Julia; vendor-portable GPU kernels (KernelAbstractions.jl) run on NVIDIA, AMD and Intel hardware from a single source tree.

- Design and test trans-dimensional probabilistic methods that characterize error and quantify uncertainty in gravity and magnetic models, improving subsurface resolution where data are underdetermined.
- Plan and conduct terrestrial gravimetry and magnetometry field campaigns (survey design, instrument deployment, and data quality control), integrating sensor-level error sources into large-scale probabilistic modeling workflows; results presented at AGU, SSA, and NASA venues.

Scientific Software & HPC Support (informal role)

2022 – Present

Zaratan Cluster, University of Maryland

- Serve as the department's de facto first point of contact for research-computing help: build, deploy, and debug research software stacks spanning legacy fixed-form Fortran, parallel MATLAB, NumPy, and PyTorch; guide serial-to-parallel and GPU migrations on shared cluster resources.
- Developed and periodically deliver the department's informal introduction to research computing for graduate students, from shell basics through GPU use and job submission.

Graduate Research Assistant

2019 – 2021

Wayne State University, Detroit, MI

- Developed trans-dimensional Bayesian inversion algorithms for gravity and structural datasets in rift-related crustal environments; seismic line and electrical-resistivity field acquisition; geological mapping and petrophysical analyses validating computational models.

TECHNICAL EXPERTISE

Languages: Python, MATLAB (incl. parallel MATLAB), Julia, Fortran (modern and legacy fixed-form), C/C++, R, SAS.

GPU & Parallel Computing: CUDA, HIP, SYCL, OpenMP, MPI, KernelAbstractions.jl, PyTorch, Triton.

HPC Deployment & Tooling: Spack, CMake, Lmod, Slurm, Flux, Git, shell scripting, Linux/Unix.

Methods: Bayesian and trans-dimensional inversion; error modeling and uncertainty quantification; deep learning; seismic waveform analysis for source characterization; low-rank approximation; quasi-random sampling.

Geophysical Domains: Potential-field methods (gravimetry, magnetometry), seismology, multi-modal geophysical data integration.

Instrumentation & Edge: Terrestrial gravimetry and magnetometry systems, antenna design, circuit analysis, Raspberry Pi, NVIDIA Jetson.

Systems & Tools: ArcGIS, LTSpice, 4nec2.

CONFERENCE PRESENTATIONS AND ABSTRACTS

- Moyer, B. (2026). "Gigavoxels and How to Afford Them: Verified-Forward Trans-Dimensional MCMC Gravity & Magnetism on One Cheap GPU." Poster, DOE CSGF Annual Program Review.
- Moyer, B., Lekić, V. (2026). "On the Feasibility of Single-Station Scalar Moment Estimation for Earthquake and Non-Earthquake Sources." SSA Annual Meeting, Pasadena, CA.
- Moyer, B., Lekić, V., Schmerr, N.C., Pitarka, A., Kim, K., Ezzedine, S.M. (2025). "From Waves to Yields: AI-Powered Insights into Explosion Source Parameters." AGU Fall Meeting, S43A-06.
- Moyer, B., Burdick, S., Schmerr, N.C., Lekić, V. (2024). "The Long or the Short of It: Optimizing Chain Length and Number in a Probabilistic Joint Inversion Framework." AGU Fall Meeting, NS21A-03.
- Myers, H.P., Moyer, B., Pick-Aluas, A., Lathrop, D.P., Taffel, M., Lekić, V. (2023). "Detecting UXO and Landmines in Realistic Minefield Conditions using Multi-Modal Geophysical Data." AGU Fall Meeting, NS43A-06.
- Moyer, B., Myers, H., Schmerr, N.C., Lekić, V. (2023). "Bayesian Inversion of Magnetic Data with Improvements from Constrained Low-Rank Approximation and Quasi-Random Sampling." AGU Fall Meeting, GP33D.
- Moyer, B., Schmerr, N.C., Lekić, V. (2023). "Joint Inversion of Gravity and Magnetic Data for Lava Tube Detection and Characterization." NASA Exploration Science Forum.
- Moyer, B., Burdick, S., Lekić, V., Schmerr, N.C. (2022). "Joint, Probabilistic Gravity and Magnetic Inversions for Planetary Exploration." AGU Fall Meeting, DI43A-05.
- Moyer, B., Burdick, S. (2021). "A Trans-dimensional Bayesian Approach to the Inversion of Gravitational and Structural Data." AGU Fall Meeting, G33A-06.
- Moyer, B., Burdick, S. (2020). "Rift Related Structure Near the Keweenaw Peninsula from a Novel Trans-dimensional Bayesian Inversion of Gravity and Structural Data." AGU Fall Meeting, T041-0003.

TEACHING

Instructor of Record – ESG 1010: Geology, The Science of the Earth

Winter 2022

Wayne State University (Enrollment: 33)

- Sole instructor for the lecture course; designed and led a one-day field excursion reinforcing course material.

PROFESSIONAL SERVICE AND AFFILIATIONS

- Co-convenor, “Data-Driven and Computational Characterization of Non-Earthquake Seismoacoustic Sources,” SSA Annual Meetings 2025 (Baltimore, MD) and 2026, with S.M. Ezzedine and K. Kim (Lawrence Livermore National Laboratory); session sustained across consecutive years.
- Volunteer, SSA Annual Meeting, 2025 (Baltimore, MD).
- Member: ACM, AGU, GSA, SSA.