Nicholas A. Gabriel

+1 (202) 505-0817 | nickgabriel8@gmail.com | Washington, DC, USA | LinkedIn | GitHub

Research and Work Experience:

The George Washington University — **Washington, DC**
Research Assistant — *May 2019 - September 2025*

Multiscale Transformers for complex systems: [paper] [github]

- Proposed a novel generative AI framework for multiscale modeling of complex systems.
- Developed modules based on transformers, graph neural networks, and neural operators for multimodal processing of graphs and timeseries in Tensorflow/JAX.
- Trained the largest physics-informed neural operator to date, ROMA-H (1.4B params).

Graph learning for foreign influence detection: [paper] [github]

- Developed a framework for detecting foreign influence on social media using graph neural networks in PyTorch.
- Identified models and features that can generalize across influence operation campaigns with feature attribution.
- Led data collection efforts for social media tracking of foreign influence and extremist communities.
- Wrote data collection tools for social media using Python Selenium and Beautiful Soup.

LLM Finetuning/GraphRAG: [github]

- Finetuned a LLM/GNN GraphRAG system for Q&A on the STaRK-Prime Knowledge Graph with PyTorch.
- Added support for parameter-efficient finetuning (QLoRA) and distributed training (FSDP/DDP).
- Improved GNN architecture for encoding KG as soft prompt tokens.

LLM Foundation Model Training: [github]

- Designed experiments to evaluate efficient architectures and optimizers for training LLMs.
- Implemented a training pipeline for cloud deployment with CI/CD, unit tests, and experiment tracking using Gitlab and WandB.

Brookhaven National Laboratory — **Upton, NY**
Intern — *June 2016 - August 2016*

- Developed software for simulation and analysis of radioactive sources for the PROSPECT neutrino experiment.
- Primary deliverables: Bash scripts, NumPy and SciPy code, and CERN ROOT modules.

Massachusetts General Hospital — **Boston, MA**
AAPM Undergraduate Fellow — *June 2015 - August 2015*

- Prototyped an interface for real-time gaze tracking during proton radiotherapy treatment of ocular melanoma.
- Implemented PyQT and OpenCV for the frontend and backend of the interface, respectively.

Education:

The George Washington University — **Washington, DC**
Ph.D. Physics — *2025*

The George Washington University — **Washington, DC**
M.S. Physics — *2020*

University of Mary Washington — **Fredericksburg, VA**
B.S. Mathematics (with honors), B.S. Physics — *2017*

Technical Skills:

Python, C/C++, Bash, Hugging Face, BLAS, TeX, CUDA C, MATLAB, Pandas, Dask, NumPy, PyTorch, JAX, Tensorflow, pytorch geometric, NetworkX, peft, accelerate, bitsandbytes, NLTK, Gensim, Selenium, Beautiful Soup, huggingface, llama, pinecone, llamaindex, OpenAI, anthropic, Linux, software engineering, Agile, high-performance computing, Git, version control, SSH, Vim, Conda, Docker, Kubernetes, Slurm, SQL, Neo4j, cloud computing, AWS, GCP, data science, data mining, Machine Learning (ML), deep learning, Artificial Intelligence, Transformers, physics-informed neural networks, neural operators, graph neural networks, geometric deep learning, sequential modeling, computational biology, knowledge graphs, Natural Language Processing (NLP), computer vision, Large Language Models (LLM), fine-tuning, LoRA/QLoRA, RAG, GraphRAG, langchain, langgraph, langsmith multimodal learning, uncertainty quantification, Explainable AI, compliance, prototypes, rapid prototyping, CI/CD, Statistics, Multivariate Calculus, Linear Algebra, Differential Geometry, Numerical Analysis, Partial Differential Equations, Multivariate Timeseries Analysis, Graph Theory, Experimental Design

Publications:

1. **N.A. Gabriel**, N.F. Johnson, G.E. Karniadakis (2025) "Connecting the geometry and dynamics of many-body complex systems with message passing neural operators" In Review: *Nature Communications*

2. **N.A. Gabriel**, D.A. Broniatowski, N.F. Johnson (2023) "Inductive detection of influence operations via graph learning" *Scientific Reports*

3. **N.A. Gabriel**, N.F. Johnson (2022) "Using Neural Architectures to Model Complex Dynamical Systems" *Advances in Artificial Intelligence and Machine Learning*

4. N. Velasquez, R. Leahy, N. Restrepo, Y. Lupu, R. Sear, **N.A. Gabriel** et. al. (2021) "Online hate network spreads malicious COVID-19 content outside the control of individual social media platforms" *Scientific Reports*

5. N.F. Johnson, N. Velásquez, N. Restrepo, R. Leahy, **N.A. Gabriel** et. al. (2020) "The online competition between pro-and anti-vaccination views" *Nature*

6. R.F. Sear, N. Velásquez, R. Leahy, N. Restrepo, S. El Oud, **N.A. Gabriel** et. al. (2020) "Quantifying COVID-19 content in the online health opinion war using machine learning" *IEEE Access*

Invited Presentations:

1. **Yale University** (Lu Group meeting, 45m presentation) [slides]
   "Message Passing Neural Operators for Many-body Complex Systems", 8/13/2025

2. **The George Washington University** (ENIGMA seminar, 45m presentation) [slides]
   "Multiscale Operator Learning for complex social systems", 10/4/2023

3. **Brown University** (CRUNCH group meeting, 40m presentation) [slides] [video]
   "Multiscale Operator Learning for complex social systems", 9/15/2023

4. **IC2S2 2022** (Conference talk, 15m presentation) [slides]
   "Automated Detection of Information Operations Using Graph Neural Networks", 7/21/2022

5. **Brookhaven National Laboratory** (PROSPECT group meeting, 20m presentation) [report]
   "Mass calibration for PROSPECT", 8/10/2016