

Sam Foreman

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Education

University of Iowa

PH.D. PHYSICS

Iowa City, IA

2015–2019

- Dissertation: [Learning Better Physics: A Machine Learning Approach to Lattice Gauge Theory](#)

University of Illinois at Urbana-Champaign

Champaign, IL

B.S. ENGINEERING PHYSICS

2010–2015

- Dissertation: [Energy Storage in Quantum Resonators](#)

University of Illinois at Urbana-Champaign

Champaign, IL

B.S. APPLIED MATHEMATICS

2010–2015

Experience

Argonne National Laboratory

Leadership Computing Facility (ALCF)

POSTDOCTORAL RESEARCH ASSOCIATE

2019 – Current

- Active member of the data science group.
 - Responsible for building, testing, documenting, and maintaining current ML frameworks and libraries across LCF's various supercomputing clusters (e.g. [Theta/ThetaGPU](#))
 - Presentation on [Hyperparameter Search Using DeepHyper on Theta](#) at the *ALCF: Simulation, Data, and Learning Workshop for AI*, 2020
 - Presentation on [Scaling Deep Learning Applications](#) (*recording*) at the *2021 Computational Performance Workshop*
 - Lead and contribute to discussions in our journal club, most recently presented on [Switch Transformers](#)
- Designed and implemented novel network architectures to improve current sampling techniques for Lattice QCD
- Extensive development (sole author) on [l2hmc-qcd](#), a (feature-packed) python library for distributed, data-parallel training, tracking, and testing of different generative models for sampling in lattice gauge models
 - Shown to provide $\sim 100\times$ speedup compared to current methods
 - Ongoing work to scale up to full Lattice QCD

Argonne National Laboratory

Computational Sciences Division

GRADUATE RESEARCH FELLOW

2018 – 2019

- Software development focused on applying machine learning models to help improve the efficiency of Hybrid Monte Carlo simulations and their use in Lattice QCD.
- Built and deployed custom ML models on some of the world's fastest supercomputers ([Theta/ThetaGPU](#)) using state-of-the-art high-performance computing techniques.

University of Iowa

Department of Physics & Astronomy

RESEARCH ASSISTANT

2016 – 2017

- Software and hardware development for HaloSat, a nanosatellite built with the goal of better understanding the missing baryon problem.
- Implemented a variety of in-flight optimization algorithms aimed at maximizing the incoming X-ray signals (by minimizing background noise) while in operation.

University of Illinois

Center for Complex Systems Research

RESEARCH ASSISTANT

2011 – 2015

- Actively maintained the legacy code base (C++ / MATLAB) for our research group and was in charge of quality analysis of new contributions.
 - Co-inventor on a patent (pending) titled “Energy Storage in Quantum Resonators”

Publications & Talks

- S. Foreman, X.Y. Jin, & J.C. Osborn, [LeapFrogLayers: A Trainable Framework for Effective Topological Sampling](#), *Lattice*, 2021
- S. Foreman, L. Jin, X.Y. Jin, A. Tomiya, J.C. Osborn, & T. Izubuchi, [HMC with Normalizing Flows](#), *38th Intl. Symposium on Lattice Field Theory*, 2021
- S. Foreman, invited talk on [l2hmc-qcd](#) at the *MIT Lattice Group Seminar*, 2021
- S. Foreman, invited talk on [Deep Learning HMC for Improved Gauge Generation](#) to the *Machine Learning Techniques in Lattice QCD Workshop*, 2021
- S. Foreman, X.Y. Jin & J.C. Osborn, [Deep Learning Hamiltonian Monte Carlo](#), *SimDL Workshop ICLR*, 2021
- S. Foreman, X.Y. Jin, & J.C. Osborn, [Machine Learning and Neural Networks for Field Theory](#) *SnowMass*, 2020
- S. Foreman, invited talk on [Machine Learning for Lattice QCD](#) at the *University of Iowa*, 2020
- S. Foreman, contributed talk [Machine learning inspired analysis of the Ising model transition](#) to *36th Intl. Symposium on Lattice Field Theory*, 2018
- S. Foreman, Y. Meurice, J. Giedt & J. Unmuth-Yockey, [Examples of renormalization group transformations for image sets](#) *Physical Review E*, 2018
- S. Foreman, invited talk on [Machine Learning Analysis of Ising Worms](#) at *Brookhaven National Laboratory*, 2017
- S. Foreman, J. Giedt, Y. Meurice & J. Unmuth-Yockey, [RG inspired Machine Learning for lattice field theory](#) *arXiv:1710.02079*, 2017
- A. Hubler, S. Foreman, J. Liu, & L. Wortsman, [Large Energy Density in Three-Plate Nanocapacitors due to Coulomb Blockade](#) *J. Appl. Phys.*, 2018