

Sam Foreman

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Education

PhD. Physics

University of Iowa

Learning Better Physics: A Machine Learning Approach to Lattice Gauge Theory

2015—2019

B.S. Engineering Physics, B.S. Applied Mathematics

Univ. of Illinois at Urbana-Champaign

Energy Storage in Quantum Resonators

2010—2015

Experience

Argonne National Laboratory

Leadership Computing Facility (ALCF)

POSTDOCTORAL RESEARCH ASSOCIATE

2019 – Current

- Data science group
 - Responsible for building, testing, and documenting current ML frameworks and libraries on modern HPC infrastructures
 - Presentation on [Hyperparameter Search Using DeepHyper on Theta](#) @ *ALCF: Simulation, Data, and Learning Workshop*
 - Presentation on [Scaling Deep Learning Applications](#) (*recording*) @ *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 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 for simple models

Argonne National Laboratory

Computational Sciences Division

GRADUATE RESEARCH FELLOW

2018 — 2019

- Recipient of the DOE Office of Science Graduate Student Research Program
- Software development focused on applying machine learning models to help improve the efficiency of Hybrid Monte Carlo simulations
- Developed techniques for efficiently scaling ML models on next generation HPC infrastructures

University of Iowa

Department of Physics & Astronomy

RESEARCH ASSISTANT

2016 — 2017

- Software and hardware development for HaloSat, a nanosatellite built to help the missing baryon problem
- Implemented a variety of in-flight optimization algorithms to maximize the signal-to-noise ratio while in operation
- Helped to write and test telemetry system using VERILOG and XILINX.

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”
- Constructed a model capable of describing the energy density and self-discharge time of nanoscale capacitors

Publications & Talks

- **S. Foreman**, invited talk on [Accelerated Sampling Methods for Lattice Gauge Theory](#) at BNL-HET & RBRC Joint Workshop “DWQ @ 25”, Dec 2021
- **S. Foreman**, invited talk on [Training Topological Samplers for Lattice Gauge Theories](#) at ML for HEP, on and off the Lattice ECT*–Trento, Sep 2021
- **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. Wortschmann, [Large Energy Density in Three-Plate Nanocapacitors due to Coulomb Blockade](#) *J. Appl. Phys*, 2018