

Tyler James Burch

DATA ANALYSIS, MACHINE LEARNING, PARTICLE PHYSICS, PERFORMANCE COMPUTING

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Experience

Argonne National Laboratory

Lemont, IL

POSTDOCTORAL APPOINTEE - PARTICLE PHYSICS SIMULATION WITH MACHINE LEARNING ON EXASCALE SUPERCOMPUTERS

May 2020 - Present

- Adapting particle physics simulation software (**MadGraph**) to Intel's oneAPI for use on the first US exascale supercomputer
- Studying Bayesian uncertainty quantification methods in machine learning models used in particle physics object identification

Northern Illinois University

DeKalb, Illinois

GRADUATE RESEARCH ASSISTANT

May 2015 - March 2020

- Main analyzer on a team searching for a rare physics process, Higgs boson pair production, in one of the world's largest datasets
 - Generated simulation of previously unstudied particle physics processes and detector effects using Monte Carlo methods
 - Employed an XGBoost multiclassifier to identify candidate signal events, ultimately improving projected Asimov significance by 10%
- Studied detector signatures to identify those coming from photons, ultimately showing up to a 25% improvement in background rejection over previous methods
 - Employed new variables which parameterize the topology of the signature in the detector
 - Studied transition of cut-based methods to an XGBoost decision tree and a neural network developed in Keras
- Involved in the commissioning of an FPGA-based hardware system, which tracks particle trajectories in real-time
- Performed shift work for general operations, both running the detector and as an on-call expert
- Research mentor of 3 undergraduate physics students, instructor of two undergraduate general physics laboratory courses

Skills

Programming Languages Python, C++, Matlab

Libraries and Frameworks Numpy, Pandas, Scikit-Learn, XGBoost, Keras, PyTorch, Scipy, Matplotlib, Seaborn, Jupyter, CUDA, SYCL

Computing and software Git, SVN, \LaTeX , JIRA, Emacs, VSCode, Microsoft Office

Education

Northern Illinois University

DeKalb, IL

DOCTOR OF PHILOSOPHY

August 2014 - March 2020

- **Thesis** - A search for resonant and non-resonant di-Higgs production in the $\gamma\gamma b\bar{b}$ channel using the ATLAS Detector
- **CERN (European Organization for Nuclear Research)**, Geneva, Switzerland — April 2017 - August 2018

Murray State University

Murray, KY

BACHELOR OF SCIENCE, CUM LAUDE

August 2011 - May 2014

- Major in physics, minors in mathematics and music

Awards

DOE Office of Science Graduate Student Research (SCGSR) Fellowship

Lemont, Illinois

PROPOSAL: UTILIZING MACHINE LEARNING CLASSIFIERS FOR PHOTON IDENTIFICATION

September 2018 - August 2019

Publications & Talks

Phenomenology Symposium (PHENO) 2019

University of Pittsburgh

ATLAS SEARCHES FOR VH/HH RESONANCES

Invited Talk - May 6, 2019

Search for Higgs boson pair production in the $\gamma\gamma b\bar{b}$ final state with 13 TeV pp collision data collected by the ATLAS experiment

J. HIGH ENERG. PHYS. (2018) 2018: 40.

Publication - November 7, 2018

Higgs Boson Pair Production at Colliders: Status and Perspective

REVIEWS IN PHYSICS, P. 100045.DOI:HTTPS://DOI.ORG/10.1016/J.REVIP.2020.100045.

White Paper - September 30, 2019

Sole author of Section 5.6: HH production in the VBF mode

282 publications as a member of the ATLAS Collaboration, January 2017 to present