Christopher Culver

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Summary

Research Assistant at the University of Liverpool with a Ph.D. studying particle physics using quantum computing and machine learning methods. Experience programming CPU and GPU simulations for supercomputers and performing statistical data analysis. Regularly invited to present research at international conferences and published in academic journals, including PRL which targets a broad physics audience.

EXPERIENCE

Research Assistant, Sept 2020 - Present
University of Liverpool, Liverpool, UK

- Researching quantum computing and machine learning methods to particle physics theories that extend the standard model.
- Applying aforementioned methods to simple models which can also be solved exactly to ensure correctness and sort out implementation details.
- Comparing efficiency of new approaches to traditional high performance computing (HPC) Monte Carlo simulations.

Graduate Student, 2014-2020
George Washington University, Washington, D.C., USA

- Predicted subatomic particle properties with Monte Carlo simulations and compared to experimental measurements.
- Learned high performance computing and managed projects on different supercomputing systems.
- Wrote CPU/GPU code in C++/CUDA for numerically expensive applications. Analyzed data and created publication quality plots in Mathematica.
- Created a workflow to generalize and automate the aforementioned code for different subatomic particles.
- Worked and taught alongside a professor in a collaborative classroom environment.

NASA Intern, Summer 2018 & 2019
NASA Goddard Space Flight Center, Maryland, USA

- Self-taught fundamentals of quantum computing and informed colleagues about the state of the art of the field.
- Ran algorithms on quantum computers to understand the physical limitations of quantum computing.
- Analyzed an algorithm to solve linear systems which has applicability across many domains.

SKILLS

C++, Python, CUDA, Rust, Linux, Mathematica, LaTeX

Statistics, Data Analysis, Monte Carlo Simulation, Scientific Presentation

Analytic Thinking, Self-management, Adaptability, Collaborative, Verbal Communicationx

ACHIEVEMENTS

1 Publication in Physical Review Letters
7 Publications in Physical Review D.
1 Publication in Proceeds of Science

7 Invited Presentations
4 Contributed Presentations

2 USQCD Computing Allocations for GPU machines

Parke Prize for Excellence in Theoretical Physics, 2020

Prof. Joseph P. Harper Award for Excellence in Physics, 2013

EDUCATION

The George Washington University, Washington D.C., USA
Ph.D. in Physics 2020
M.Phil. in Physics 2018
HPC Certificate 2018

University of Scranton, Scranton, PA, USA
B.S. in Physics 2013

PUBLICATIONS

C. Culver, D. Schaich, Quantum computing for lattice supersymmetry, PoS Lattice 2021, 153, 2022

D. Sadasivan, A. Alexandru, H. Akdag, F. Amorim, R. Brett, C. Culver, M. Döring, F.X. Lee, M. Mai, Pole position of the a1(1260) resonance in a three-body unitary framework, Phys. Rev. D, 105, 054020, 2022

R. Brett, C. Culver, M. Mai, A. Alexandru, M. Döring, F.X. Lee, D. Sadasivan, Three-body dynamics of the a1(1260) resonance from lattice QCD, Phys. Rev. Lett, 127, 222001, 2021

R. Brett, C. Culver , M. Mai, A. Alexandru, M. Döring, F.X. Lee, Three-body interactions from the finite-volume QCD spectrum, Phys. Rev. D, 104, 014501, 2021

A. Alexandru, R. Brett, C. Culver, M. Döring, D. Guo, F.X. Lee, M. Mai, Finite-volume energy spectrum of the $K^- K^- K^-$ system, Phys. Rev. D, 102, 114523, 2020

C. Culver, M. Mai, R. Brett, A. Alexandru, M. Döring, Three pion spectrum in the I=3 channel from lattice QCD, Phy. Rev. D, 101(11), 114705, 2020

M. Mai, M. Döring, C. Culver, A. Alexandru, F.X. Lee, Three-body unitarity versus finite-volume $\pi^+\pi^+\pi^+$ spectrum from lattice QCD, Phys. Rev. D, 101, 054510, 2020

M. Mai, C.Culver, M. Döring, A. Alexandru, F.X. Lee, A cross-channel study of pion scattering from lattice QCD, Phys. Rev. D, 100, 114514, 2019

C. Culver, M. Mai, A. Alexandru, M. Döring, F.X. Lee, Pion scattering in the isospin I=2 channel from elongated lattices, Phys. Rev. D, 100(3), 034509, 2019

JOURNAL REFEREE

Physical Review Letters, 3 reviews since 2021

Physical Review D, 3 reviews since 2021

COMPUTING ALLOCATIONS AS PRINCIPAL INVESTIGATOR

50,000 GPU hours from USQCD in 2021, for "Lattice Study of the a1(1260) resonance"

90,000 GPU hours from USQCD in 2020, for "Lattice Study of the a1(1260) resonance"

INVITED TALKS

Extracting the a1(1260) finite-volume spectrum with elongated lattices, Bethe Forum Multihadron Dynamics in a Box, Bethe Center for Theoretical Physics, Bonn, Germany, August 2022

The a1(1260) resonance from Lattice QCD, Particle Physics Theory Seminar, University of Edinburgh, Edinburgh, UK, Feb 2022

Three-pion scattering from lattice QCD, Fundamental Particle Physics Group Physics Seminar, University of Liverpool, Liverpool, UK, October 2020

Hadron Spectroscopy and the a1(1260), USQCD All-Hands Meeting, Virtual/Jefferson Lab, Virginia, USA, May 2020,

Three-body spectrum from lattice QCD, Nuclear Seminar, George Washington University, Washington D.C., USA, November 2019

Progress on 3 pions from elongated boxes, Bethe Forum Multihadron Dynamics in a Box, Bethe Center for Theoretical Physics, Bonn, Germany, September 2019

Hadron scattering from elongated lattices, Scattering form the lattice, Applications to Phenomenology and Beyond, Trinity College, Dublin, May 2018

CONTRIBUTED TALKS

Quantum computing for lattice supersymmetry, The 39th International Symposium on Lattice Field Theory, Bonn, Germany, August 2022

Quantum computing for lattice supersymmetry, The 38th International Symposium on Lattice Field Theory, Zoom/Gather@MIT, July 2021

Pion-pion scattering with elongated boxes, Fall Meeting of the Division of Nuclear Physics of the American Physical Society, Arlington, VA, October 2019

Pion-pion scattering with elongated boxes, The 37th International Symposium on Lattice Field Theory, Wuhan, China, June 2019