# Michael Heinz - Curriculum Vitae

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## EDUCATION

**University of California Berkeley** August 2020 - Present
Ph.D. in Applied Mathematics

**The Ohio State University** August 2016 - May 2020
B.Sc. in Mathematics and Physics with Honors (double major)
Overall GPA (4.00 scale): 4.00; Major GPA: 4.00
Graduation honors: Summa Cum Laude with Honors Research Distinction in Mathematics
Thesis: *New Resummation Techniques of Divergent Series: the Painlevé Equation $P_{II}$*

## RESEARCH EXPERIENCE

**Improving High-Energy Particle Detectors with Machine Learning** June 2020 - August 2020
*Research Intern at Lawrence Livermore Nat'l Lab advised by Aaron Angerami* *Livermore, CA*

- Conducted DOE-funded research to use machine learning techniques to improve particle reconstruction of the ATLAS calorimeter for particles produced in high-energy nuclear collisions
- Utilized TensorFlow and Keras to train models and make predictions on new data
- Applied classification and energy regression in succession to make calibrated energy predictions for data including multiple types of particle showers
- Implemented a data generator using `uproot` to load input data into memory from root files as needed
- Presentation:
  - Summer SLAM! August 2020
    *Lawrence Livermore National Laboratory*

**Resummation of Divergent Series** February 2018 - May 2019, August 2019 - May 2020
*Undergraduate Research Asst. advised by Prof. Ovidiu Costin (Mathematical Physics)* *Columbus, OH*

- Conducted university-funded research on advanced methods for resummation of divergent series to convergent solutions that give maximum information about the behavior of the associated function when dealing with incomplete information
- Applicable to various fields including obtaining higher precision in critical expansions at low and high temperatures in statistical mechanics
- Applied a new method of resummation developed by Prof. Costin to Painlevé Equation PII
- Conference and Forum Presentations:
  - Young Mathematicians Conference August 2019
    *The Ohio State University*
  - Denman Undergraduate Research Forum February 2019
    *The Ohio State University*
  - Autumn Undegraduate Research Festival November 2018
    *The Ohio State University*
- Publication:
  - O. Costin and M. Heinz, *Rational Approximations for Painlevé PII Solutions* In preperation

**Hydrodynamic Fluctuations in High-Energy Nuclear Collisions** May 2019 - July 2019
*Wayne State JETSCAPE REU advised by Prof. Chun Shen (High-Energy Nuclear Theory)* *Detroit, MI*

- Conducted research funded by JETSCAPE on the smoothed particle hydrodynamics method (SPH) to solve partial differential equations for hydrodynamic fluctuations in high-energy nuclear collisions
- Wrote an open source code package in C++ with C++ 11 standard, as well as a summarizing report
- `https://bitbucket.org/wayne_state_nuclear_theory/sph_solver/src/master/`

**Virtual Knot Invariants** June 2017 - December 2017
*Knots and Graphs Research Program advised by Prof. Sergei Chmutov* *Columbus, OH*

- Conducted university-funded cutting-edge research on multiple knot invariants for virtual knots
- Worked to develop a novel knot invariant that would expand on current knowledge and distinguish more virtual knots
- Helped develop a program to output different knot invariants for any inputted virtual knot
- `https://people.math.osu.edu/chmutov.1/wor-gr-su17/wor-gr.htm`

**Exploration in Low-Energy Nuclear Theory** June 2016 - December 2016
*Undergraduate Research Asst. to Prof. Robert Perry (Low-Energy Nuclear Theory)* *Columbus, OH*

- Independently studied various problems in quantum mechanics and discussed findings with Prof. Perry
- Attended research meetings of the Low-Energy Nuclear Theory group

## WORK EXPERIENCE

**The Ohio State University Dept. of Mathematics** Aug. 2017 - Dec. 2017, Aug. 2018 - May 2020
*Student Instructional Assistant* *Columbus, OH*

- Lead two bi-weekly Precalculus recitations of 30+ students each semester
- Facilitate discussion, solve problems, and address students' questions about material
- Assist students outside of recitation through tutoring and office hours
- Administer quizzes and exams throughout the semester

**Colburn Hill Group** November 2018 - May 2019
*Contractor* *Columbus, OH*

- Created AI using UiPath to scrape relevant information from health care sites and post to databases

**Math and Stats Learning Center at The Ohio State University** January 2018 - May 2018
*Mathematics Tutor* *Columbus, OH*

- Explained Calculus and other mathematics concepts in simplified language to increase understanding
- Helped students of various ages and levels connect concepts to continuously expand knowledge
- Identified individual learning levels of different students and broke down complex problems accordingly

## ACADEMIC AWARDS

- Senior Alumni Award Winner — April 2020
  *Department of Physics* — *The Ohio State University*
- Goldstein Math Scholarship — Spring 2020
  *Department of Mathematics* — *The Ohio State University*
- Goldstein Math Scholarship — Autumn 2019
  *Department of Mathematics* — *The Ohio State University*
- Smith Junior Award Winner — April 2019
  *Department of Physics* — *The Ohio State University*
- Merit Scholarship from Gordan Memorial Fund — Spring 2019
  *Department of Mathematics* — *The Ohio State University*
- Merit Scholarship from Gordan Memorial Fund — Autumn 2018
  *Department of Mathematics* — *The Ohio State University*
- Smith Sophomore Award Winner — April 2018
  *Department of Physics* — *The Ohio State University*

· Honorable Mention in the Gordon Mathematics Competition — March 2018
*Rasor-Bareis-Gordon Mathematics Competition* — *The Ohio State University*

· Merit Scholarship from George Majda Scholarship Fund — Spring 2018
*Department of Mathematics* — *The Ohio State University*

· Merit Scholarship from George Majda Scholarship Fund — Autumn 2017
*Department of Mathematics* — *The Ohio State University*

· Helen Cowan Book Award Winner — April 2017
*Department of Physics* — *The Ohio State University*

· Second Place in the Gordon Mathematics Competition — March 2017
*Rasor-Bareis-Gordon Mathematics Competition* — *The Ohio State University*
  – awarded Goldstein Mathematics Scholarship

· Merit Scholarship from Morris Endowment Fund — Autumn 2016
*Department of Mathematics* — *The Ohio State University*

· Maximus Scholarship — Autumn 2016 - Spring 2020
*The Ohio State University*

## TALKS AND PRESENTATIONS

· "Improving High-Energy Particle Detectors with Machine Learning" — August 2020
*Summer SLAM!* — *Lawrence Livermore National Laboratory*

· "New Resummation Techniques of Divergent Series: the Painlevé Equation $P_{II}$" — April 2020
*Bachelor's thesis: defense* — *The Ohio State University*

· "Padé Approximations and their Applications" — January 2019
*Given for the Low-Energy Nuclear Theory group* — *The Ohio State University*

· "Helley's Theorem on Convex Sets" — November 2016
*Given in Math 5529H, Honors Combinatorics* — *The Ohio State University*

## SKILLS AND ACTIVITIES

**Technical Skills:**

· Numerical computing (Python: numpy, scipy, matplotlib; C++; Maple; Mathematica)
· Machine learning (TensorFlow; Keras)
· Version control (git)
· Documenting results (LaTeX; Microsoft Office)
· Other languages: UiPath

**Language Skills:**

· English (native)
· German (native)

**Activities:**

· Member of the Radical Pi Math Club at OSU — August 2016 - May 2020
· Bassist in The Buckeye Philharmonic Orchestra — August 2016 - May 2019
· Putnam Competition participant (achieved best score of 20, rank 693.5 out of 4,638) — 2016, 2017