

# Kevin Luna

## Curriculum Vitae

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## Education

- 2016 – 2022 **Ph.D Applied Mathematics**, *University of Arizona*, Tucson, Arizona.  
Ph.D minor Aerospace Engineering
- 2016 – 2018 **M.S Applied Mathematics**, *University of Arizona*, Tucson, Arizona.
- 2013 – 2016 **B.S Physics**, *Northern Arizona University*, Flagstaff, Arizona.  
Graduated Magna Cum Laude  
Chemistry Minor
- 2013 – 2016 **B.S Mathematics**, *Northern Arizona University*, Flagstaff, Arizona.  
Graduated Magna Cum Laude

## Experience

### Research

- May 2020 – Present **Research Intern**, NATIONAL ENERGY RESEARCH SCIENTIFIC COMPUTING CENTER (NERSC), Berkeley, California.  
Interning in the Data Science Engagement group at NERSC. Working on leveraging deep learning techniques to improve preconditioners for iterative linear solvers with the goal of implementing these methods in low Reynolds number fluid flow applications.
- August 2016 – Present **Graduate Assistant**, UNIVERSITY OF ARIZONA, Tucson.
  - Research focused on studying receptivity and stability of high speed boundary layers in chemical non-equilibrium within the context of fluctuating hydrodynamics
  - Developing and applying both theoretical and computational tools for a particular boundary layer stability problem
- June 2019 – **Research Intern**, LAWRENCE BERKELEY NATIONAL LABORATORY, Berkeley, California.
- August 2019 Interned in the Multiscale Modeling and Stochastic Systems group within the Center for Computational Sciences and Engineering. Worked on extending an importance sampling method known as umbrella sampling to the context of partial differential equations with noise
- August 2014 – **Undergraduate Resercher**, NORTHERN ARIZONA UNIVERSITY, Flagstaff, Arziona.
- May 2016 Independently worked on a research project focused on the development and application of novel numerical methods to analyze the dynamical behavior of a certain class of nonlinear ODE/PDEs with bifurcation parameters
- May 2015 – **Research Intern**, NORTH CAROLINA STATE UNIVERSITY, Raleigh, North Carolina.
- July 2015 Worked in a collaborative environment on the investigation of the convergence of derivatives of numerical solutions of ODE/PDE formulations of interface problems using the immersed interface method
- January 2013 **Undergraduate Researcher**, UNIVERSITY OF ARIZONA, Tucson, Arizona.
- May 2013 Worked on a semester long research project funded by the WAESO LSAMP program. My work focused on theoretical and numerical aspects of Nonlinear Elasticity

### Teaching Employment

- August 2018 – **Graduate Teaching Assistant**, *University of Arizona*, Tucson, Arizona.
- May 2018 Developed lesson plans, gave lectures, graded exams and homeworks, and held office hours
- January 2016 **Math Achievement Assistant**, *Northern Arizona University*, Flagstaff, Arizona.
- May 2016 Served as a drop-in tutor for Calculus III students, and served as an in-class student teaching assistant. Employed through university Academic Success Center.

January 2015 **Learning Center Tutor**, Northern Arizona University, Flagstaff, Arizona.  
 – May 2016 Tutored content from chemistry, physics, and mathematics courses in individual sessions. Employed through university Academic Success Center.

## Research Interests

- Fluid dynamics, Fluctuating hydrodynamics, and Chemical Kinetic Modeling
- Numerical methods, asymptotic methods, and monte carlo methods
- Scientific computing, multiscale modeling, machine learning

## Skills

### Computer Skills

Languages **Advanced:** Python, Fortran 90 | **Intermediate:** C++ | **Basic:** Julia  
 Parallel libs **Intermediate:** MPI, CUDA | **Basic:** OpenMP, OpenACC  
 Misc. Tools Git, Bash, GNU make, Intel compilers and libraries(MKL), L<sup>A</sup>T<sub>E</sub>X, MATLAB  
 DL/ML LibTorch(C++), Pytorch, TensorFlow

### Languages

**English:** Native Language | **Spanish:** Fluent in speaking and reading | **Italian:** Basic

## Publications

Conference Paper K. Luna and A. Tumin. “*The Role of Fluctuating Dissipative Fluxes in the Receptivity of High-Speed Reacting Binary Mixtures to Kinetic Fluctuations*”, Orlando FL, AIAA Paper ID number 3246704, Jan 2020  
 Conference Paper K. Luna and A. Tumin. “*Receptivity of High-Speed Boundary Layers in Binary Mixture of Gases to Kinetic Fluctuations*”, San Diego CA, AIAA Paper ID number 3031690, Jan 2019  
 Govt. Tech. Report A. Tumin, L. Edwards, and K. Luna, “*Receptivity of High-Speed Boundary Layers Kinetic Fluctuations*”, Air Force Office of Scientific Research (AFOSR), technical report for AFOSR grant FA9550-15-1-0369, December 2018.

## Presentations

### Presentations- Away from home institution

Conference Talk “*The Role of Fluctuating Dissipative Fluxes in the Receptivity of High-Speed Reacting Binary Mixtures to Kinetic Fluctuations*”, American Institute of Aeronautics and Astronautics(AIAA) SciTech 2020, Orlando, Florida, January 2020  
 Conference Talk “*The Role of Fluctuating Dissipative Fluxes in the Receptivity of High-Speed Chemically Reacting Boundary Layers in Binary Mixtures to Kinetic Fluctuations*”, American Physical Society Division of Fluid Dynamics Annual Meeting, Seattle, Washington, November 2019  
 Symposium Poster “*Sampling the Thermodynamic Free Energy of a Ginzburg Landau Model*”, CRD Computing Sciences summer poster session, Berkeley, California, August 2019  
 Seminar Talk “*Sampling the Thermodynamic Free Energy of a Ginzburg Landau Model*”, Workshop on Computational Modeling of Soft Matter and Complex Fluids, Berkeley, California, July 2019  
 Conference Poster “*Receptivity of High-Speed Boundary Layers In Binary Mixture of Gases to Kinetic Fluctuations*”, Arizona - Los Alamos Days poster session, Tucson, Arizona, April 2019  
 Conference Poster “*Modification and Application of a Method for Studying Stability of High speed Boundary Layers*”, Society for Industrial and Applied Mathematics Conference on Computational Science and Engineering 2019 student poster session, Spokane, Washington, February 2019  
 Conference Talk “*Receptivity of High-Speed Boundary Layers In Binary Mixture of Gases to Kinetic Fluctuations*”, American Institute of Aeronautics and Astronautics(AIAA) SciTech 2019, San Diego, California, January 2019  
 Conference Talk “*Receptivity of High-Speed Boundary Layers In Binary Mixture of Gases to Kinetic Fluctuations*”, American Physical Society Division of Fluid Dynamics Annual Meeting, Atlanta, Georgia, November 2018

- Conference Talk “*Newton’s Method For a Semilinear Elliptic PDE on the Unit Disk*”, Southwestern Undergraduate Mathematics Research Conference, Phoenix, Arizona, February 2016
- Conference Poster “*Accurate Solution and Gradient Computation for Interface Problems*”, Joint Mathematics Meeting student poster session, Seattle, Washington, January 2016
- Symposium Poster “*Accurate Solution and Gradient Computation for Interface Problems*”, North Carolina State University research symposium, Raleigh, North Carolina, July 2015
- Conference Talk “*Applying the Galerkin Newton Gradient Algorithm*”, Southwestern Undergraduate Mathematics Research Conference, El Paso, Texas, February 2015

#### Presentations- At home institution

- Conference Poster “*The Role of Thermal Noise in Hypersonic Transition to Turbulence*”, 2019 Graduate Interdisciplinary Programs (GIDP) Student Research Showcase, University of Arizona, Dec 2019
- Seminar Talk “*Asymptotic stability of boundary layers in hypersonic chemically reacting mixtures subject to perturbations induced by thermal noise*”, University of Arizona Applied Mathematics Brown Bag Seminar, Tucson, Arizona, November 2019
- Seminar Talk “*Including Real Gas Effects in the Analysis of Boundary Layers*”, University of Arizona Applied Mathematics RTG Workshop, Tucson, Arizona, December 2018
- Seminar Talk “*Applying the Galerkin Newton Gradient Algorithm*”, Friday Afternoon Mathematics Undergraduate Seminar, Northern Arizona University, Flagstaff, Arizona, March 2015
- Seminar Talk “*Progress in Accurate Gradient Computations for Interface Problems*”, Northern Arizona University Applied Mathematics Seminar, Flagstaff, Arizona, May 2016

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#### Awards

- 2020 Received a travel grant to attend the UC San Diego 2020 Winter Workshop on Optimization, Differential Equations, and Data Analysis
- 2019 Chosen to represent Applied Mathematics program at university-wide interdisciplinary research showcase
- 2019 Don Wilson Applied Mathematics travel award recipient
- 2019 Fall Graduate Outreach Scholar
- 2019 Funded American Institute of Mathematics workshop participant
- 2019 SIAM CSE 2019 Broader Engagement travel grant award recipient
- 2018 Univ. of Arizona GPSC travel grant award recipient
- 2018 Don Wilson Applied Mathematics travel award recipient
- 2016 University of Arizona Graduate Access Fellowship
- 2016 Outstanding Poster and Poster Presenter at JMM 2016
- 2016 MAA student travel grant awardee for presenting at JMM 2016
- 2016 NAU Office of the Provost travel award recipient
- 2015 Math Alliance Predoctoral Scholar nomination and travel award
- 2014 Karan and Terence Hall Outstanding NAU Mathematics Student Scholarship
- 2014 Vesto M. Slifer Outstanding NAU Physics Student Scholarship
- 2013 Certificate of Outstanding Scholarship; NAU Dept. of Mathematics & Statistics. 2013-2016.
- 2013 Dean’s list at Northern Arizona University for Fall 2013-Spring 2016
- 2012 A.S college degree with high distinction concurrently earned with high school diploma
- 2012 Arizona Board of Regents full tuition scholarship

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## Teaching Experience

As Graduate Teaching Assistant at Univ. of Arizona

Math 112 College Algebra

Fall 2018

Math 107 Exploring and Understanding Data

Spring 2019

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## Professional Memberships

American Institute of Aeronautics and Astronautics (AIAA)

American Physical Society (APS)

Society for Industrial and Applied Mathematics (SIAM)

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## Selected Coursework

**Mathematics:** Numerical Analysis, Numerical Partial Differential Equations, Perturbation Methods in Applied Mathematics, Methods of Applied Mathematics, Monte Carlo Methods, Dynamical Systems, Stochastic Differential Equations, Operations Research, Linear Algebra, Probability and Statistics, Topology, Analysis

**Physics:** Compressible Fluid Dynamics, Incompressible Fluid Dynamics, Hydrodynamic Stability, Astrophysics, Computational Physics, Optics, Electricity and Magnetism, Classical Mechanics, Quantum Mechanics, Statistical Mechanics

**Chemistry:** General Chemistry, Organic Chemistry, Inorganic Chemistry, Physical Chemistry, Quantum Chemistry, Analytical Chemistry

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## Workshops/Trainings

Various **XSEDE HPC Workshops**, ARIZONA STATE UNIVERSITY, Tempe, Arizona.

Have attended various training workshops hosted by XSEDE. Some examples include GPU-Accelerated "Computing With CUDA Python" and "OpenACC for developing GPU capable codes".

January 2020 **Winter Workshop on Optimization, Differential Equations, and Data Analysis**, UNIVERSITY OF CALIFORNIA SAN DIEGO, San Diego, California.

Funded participant of an RTG workshop featuring a series of expository talks on advanced optimization algorithms and numerical methods for ODEs/PDEs

July 2019 **Workshop on Computational Modeling of Soft Matter and Complex Fluids**, LAWRENCE BERKELEY NATIONAL LAB, Berkeley, California.

Workshop focused on mathematical modeling and computation of complex physical systems

June 2019 **AMReX Student Training**, LAWRENCE BERKELEY NATIONAL LAB, Berkeley, California.

Week long training on the basics of the AMReX software framework for massively parallel block-structured adaptive mesh refinement (AMR) applications

March 2019 **Spring Opportunities Workshop**, AMERICAN INSTITUTE OF MATHEMATICS, San Jose, California.

Workshop focused on professional development of students in the mathematical sciences

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## Certifications

April 2020 **Fundamentals of Accelerated Computing with CUDA C/C++, NVIDIA Deep Learning Institute.**

Certificate earned for completion of course focused on accelerating and optimizing existing C/C++ CPU-only applications using CUDA tools and techniques on NVIDIA GPUs. Iterative profiler driven CUDA development techniques were stressed throughout the course.

March 2020 **Deep Learning, deeplearning.ai / Coursera Specialization.**

Five course specialization covering Convolutional Neural Networks, hyperparameter tuning, Recurrent Neural Networks, etc.

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## Leadership

- Spring 2020 **MATH 485 Project Mentor**, UNIVERSITY OF ARIZONA, Tucson, Arizona.  
Guiding a multidisciplinary team of undergraduate student's semester long projects on modeling vibrating pendulums. The project entails the development of a mathematical model, analysis, and numerical modeling. The project also consists of an experimental component where students validate their models.
- Fall 2018 **MATH 485 Project Mentor**, UNIVERSITY OF ARIZONA, Tucson, Arizona.  
Mentored a team of undergraduate student's semester long projects on epidemiology. This culminated in a poster presentation given by the student team

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## Outreach Service

- Spring 2020 **Graduate Student Peer Mentor**, UNIVERSITY OF ARIZONA, Tucson, Arizona.  
Providing mentorship and guidance to new first and second year peers in the applied mathematics graduate program
- Fall 2019 **Outreach Scholar**, APOLLO MIDDLE SCHOOL, Tucson, Arizona.  
Worked with middle school teachers in the classroom to help encourage student interest in mathematics and help struggling students. Also served as an in-class instructional aid over the course of the semester for three eighth grade math classrooms. This outreach was done at at Apollo Middle School in Tucson, a majority-minority school in an economically disadvantaged area
- Fall 2017 **Classroom Aide**, PUEBLO HIGH SCHOOL, Tucson, Arizona.  
Served as an in-class instructional assistant to students struggling in mathematics.