

# Jacob Price

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University of Puget Sound

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## Education

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<b>University of Washington</b>	2012-2018
Master of Science and Doctorate of Philosophy in Applied Mathematics Advisor: Panos Stinis	
<b>Kalamazoo College</b>	2008-2012
Bachelor's Degree with Honors in Mathematics and Physics Summa Cum Laude	

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## Honors, Awards, and Fellowships

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<b>Burlington Northern Curriculum Development Award</b>	2020
Given as part of a committee to develop a Data Science major and minor at the University of Puget Sound.	
<b>Project NExT</b>	2019-2020
Selected to participate in professional development program for new Ph.D.s in the mathematical sciences. Addresses teaching, research, service, and professional activity. Silver '19 cohort. Courses: Teaching Introductory Statistics in a Data-Driven World	
<b>Tung Family Endowment Award</b>	2018
For exemplary work by a student in the Department of Applied Mathematics.	
<b>SIAM Chapter Award</b>	2016
In recognition of outstanding efforts and accomplishments on behalf of the SIAM Chapter at the University of Washington.	
<b>Boeing Teaching Award</b>	2015
Awarded for outstanding teaching by a student in Applied Mathematics.	
<b>Los Alamos Computational Physics Fellowship</b>	2015
Awarded a summer fellowship to participate in the Los Alamos Computational Physics Workshop.	

**Top Scholar Fellowship Award** 2012

A fellowship offered by the University of Washington to promising first year graduate students.

**Park City Mathematics Institute Undergraduate Summer School** 2010

Awarded a summer fellowship to attend the undergraduate summer school on image processing.

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## Research Experience

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### University of Puget Sound

#### Reduced Order Modeling of Multiscale Systems

Developed of the complete memory approximation for the memory term of the Mori-Zwanzig formalism. Applied to classic partial differential equations from fluid dynamics including Euler's equations in two dimensions (Madelyn Shapiro) and three dimensions, and the Korteweg-de Vries equation.

**Mentee:** Madelyn Shapiro (2019)

#### Bayesian Hierarchical Models of Presidential Election Polling

Developed model for sampling and non-sampling error in public opinion polling of American presidential elections. Constructed weighted polling average and assessed the distribution of errors. Future goals include the construction of a forecasting algorithm for American elections.

**Mentee:** Haley Reed (2020, Agricola Scholar)

### University of Washington

Studied theory and applications of the Mori-Zwanzig formulation of model reduction. Theoretical research included the development and numerical analysis of novel multiscale methods for systems without scale separation. Applications include nonlinear waves, nonequilibrium phenomena, plasma modeling, and biochemical engineering.

**Mentor:** Panos Stinis

### Washington Experimental Mathematics Laboratory

Directed undergraduate mathematics students in the study of conditional path sampling. Provided background and training, and oversaw parameter exploration, algorithm development, code optimization, and literature reviews. Potential applications include transition path sampling in protein folding systems.

**Mentors:** Panos Stinis and Jayadev Athreya

**Mentees:** Jesse Rivera, Landon Shorack, Qingtong Zeng

### Los Alamos National Laboratory

Developed proof-of-principle computational framework for multiscale modeling of plasma. Created a hybrid numerical method combining molecular dynamics simulations and kinetic BGK simulations using the heterogeneous multiscale method.

**Mentors:** Michael Murillo and Jeff Haack

### Kalamazoo College Summer Research

Developed a suite of software to analyze patterns in musical compositions. Inspired by statistical mechanics, sought to quantify differences between composers in various musical eras, identify "characteristic" melodic and rhythmic patterns, and visualize harmonic structures.

**Mentor:** Eric Barth

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## Publications

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1. Shohet, G.; **Price, J.**; Haack, J.; Marciante, M.; and Murillo, M. “Heterogeneous multiscale method for high energy-density matter: Connecting kinetic theory and molecular dynamics.” *Journal of Computational Physics*. 2020. DOI: <https://doi.org/10.1016/j.jcp.2020.100070>.
2. **Price, J.** and Stinis, P. “Renormalization and blow-up for the 3D Euler equations.” **Preprint**. <https://arxiv.org/abs/1805.08766>.
3. **Price, J.** and Stinis, P. “Renormalized Reduced Order Models with Memory for Long Time Prediction.” *Multiscale Modeling and Simulation*. Society for Industrial and Applied Mathematics. Volume 17, Issue 1. 2019.

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## Posters and Presentations

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1. **Price, J.** “Should We Trust the Polls?: Making Sense of Public Opinion Polling.” Thompson Science Seminar, October 2020. Tacoma, Washington. Kalamazoo College, October 2020. Kalamazoo, Michigan (virtual).
2. **Price, J.**, Akin, T., Hazra, T., and Deterding, S. “Project NExT: How to Create Effective Homework Assignments.” Project NExT Virtual Workshop, July 2020. Virtual. **Session co-organizer**.
3. **Price, J.**, Pezzimenti, S., Charnley, M., and Torres, M. “Project NExT: Math for Non-Math Majors.” Joint Mathematics Meeting, January 2020. Denver, Colorado. **Session proposer and co-organizer**.
4. **Price, J.** “The complete memory approximation and reduced order models of partial differential equations.” Pacific Lutheran University, September 2019. Tacoma, Washington.
5. **Price, J.**, Upsal, J. “Introducing Machine Learning in Python with Movie Recommendation.” PNW Section of MAA Annual Meeting, April 2019. Portland, Oregon. MathFest, August 2019. Cincinnati, Ohio.
6. **Price, J.** “Renormalized Reduced Order Models for Long Term Prediction.” SIAM Computer Science and Engineering, January 2019. Spokane, Washington.
7. **Price, J.** “A new multiscale modeling framework for partial differential equations.” University of Washington, Tacoma, Seminar, January 2019. Tacoma, Washington.
8. **Price, J.** “Opportunities in Scientific Computing: Outsourcing the Computation So We Can Do the Thinking...” University of Puget Sound Seminar, November 2018. Tacoma, Washington.
9. **Price, J.** “Using Hands-on Experimentation to Introduce Differential Equations.” SIAM Annual Meeting, July 2018. Portland, Oregon. **Invited talk**.
10. **Price, J.** “Multiscale Techniques for Nonlinear Dynamical Systems: Applications and Theory.” May 2018. **Given in fulfillment of requirements for doctoral degree**.
11. **Price, J.** “Mastery-Based Grading in Probability and Statistics.” PNW Section of MAA Annual Meeting, April 2018. Seattle, Washington.

12. **Price, J.** “Cultivating an Inclusive Atmosphere in Scientific Computing through Diverse Historical Perspectives.” Joint Mathematics Meeting, January 2018. San Diego, California.
13. **Price, J.** “Renormalized Reduced Order Models with Memory for Long Time Prediction.” Joint Mathematics Meeting, January 2018. San Diego, California.
14. **Price, J.** and Stinis, P. “A Novel Renormalized Mori-Zwanzig Method for Model Reduction.” SIAM Annual Meeting, July 2017. Pittsburgh, Pennsylvania.
15. **Price, J.** “Constructing Novel Reduced Order Models with Memory.” PNW Section of MAA Annual Meeting, June 2017. Spokane, Washington.
16. **Price, J.** “Multiscale Techniques for Nonlinear Dynamical Systems: Applications and Theory.” General Examination Presentation, February 2017. Seattle, Washington.
17. **Price, J.**, et al. “A Heterogeneous Multiscale Model for Plasma Simulation.” University of Washington Applied Mathematics Poster Session, January 2017. Seattle, Washington. **Voted best poster, selected to be presented at SIAM Annual Meeting.** SIAM Annual Meeting, July 2017. Pittsburgh, Pennsylvania.
18. **Price, J.**, et al. “Multiscale Plasma Modeling: Coupling the BGK Equation and Molecular Dynamics.” American Physical Society Division of Plasma Physics Conference, November 2016. San Jose, California.
19. **Price, J.** “Multiscale Simulation Methods: Concepts and Applications.” Seattle University invited talk, October 2016. Seattle, Washington. South Seattle College invited talk, May 2017. Seattle, Washington. Pacific Lutheran University invited talk, September 2017. Tacoma, Washington.
20. **Price, J.**, et al. “Combining Molecular Dynamics with Kinetic Theory.” Los Alamos National Laboratory Computational Physics and Methods Technical Talk, August 2016. Los Alamos, New Mexico.
21. **Price, J.**, Shohet, G. “A Heterogeneous Multiscale Model for Plasma Simulation.” Los Alamos National Laboratory Student Symposium, July 2016. Los Alamos, New Mexico.
22. **Price, J.** “Reduced Order Modeling of Systems Without Scale Separation.” Nambé Group Meeting, June 2016. Los Alamos, New Mexico.
23. **Price, J.** “Initializing MD with Prime Numbers.” Nambé Quarterly Meeting, July 2015. Los Alamos, New Mexico.
24. **Price, J.**, Shohet, G. “The Heterogeneous Multiscale Method: Combining Molecular Dynamics with Kinetic Theory.” Nambé Quarterly Meeting, July 2015. Los Alamos, New Mexico.
25. **Price, J.**, Qian, H. “Macromolecular function is not intrinsic to structure in living cells.” Poster presentation, University of Washington Applied Mathematics poster session, May 2015. Seattle, WA.
26. **Price, J.**, Qian, H. “Beyond Structure-Function Relation: A Biochemical Circuit with Kinetically Regulated Activation-Inhibition Switching.” Frontiers in Biophysics Conference, March 2015. Vancouver, BC. **Awarded second best conference talk.**
27. **Price, J.**, Barth, E. “Numerical Tools for Describing Musical Compositions.” Midstates Conference for Undergraduate Research in Computer Science and Mathematics, November 2011. Granville, Ohio.

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## Affiliations

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<b>Mathematics Association of America</b>	2016-Present
<b>American Mathematical Society</b>	2013-Present
<b>Society for Industrial and Applied Mathematics</b>	2012-Present
<b>American Physical Society</b>	2014-2018
<b>Phi Beta Kappa Honor Society</b>	2012-Present
<b>Alpha Lambda Delta Honor Society</b>	2009-Present

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## Computer Programming Experience

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Matlab 12+ years of experience  
R 10+ years of experience  
Mathematica 9+ years of experience  
Python 5+ years of experience  
SageMath 1+ year of experience

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## Advising

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<b>University of Puget Sound Math Theses Advised</b>	
<b>Aidan Schumann</b>	2019
Isomorphisms and Transformations of Linear Differential Equations	
<b>Madelyn Shapiro</b>	2020
Reduced Order Modeling with the Complete Memory Approximation	
<b>Special Interdisciplinary Major Committees</b>	
<b>Jordan Anderson</b>	2020
Special Interdisciplinary Major in Neuroscience	
<b>Bookends Orientation</b>	2020

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## Teaching Experience

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### University of Puget Sound

**Professor, MATH 160: Introduction to Applied Statistics.** Introduced principles of statistics to student population with wide range of mathematical skill and comfort. Introduced programming language R and GUI R Studio. Developed suite of R functions to support students' statistical computations. Implemented a variety of in-class activities inspired by the Guidelines for Assessment and Instruction in Statistics Education. Fall 2018-2020  
Spring 2019, 2020

**Professor, MATH 260: Intermediate Applied Statistics.** Developed theory and practical skills relating to linear regression theory for students from a range of disciplines. Employed project-based assessment to model real-world skills. Fall 2019  
Spring 2020

**Professor, MATH 301: Ordinary Differential Equations.** Incorporated labwork and projects inspired by SIMIODE to teach analytical, numerical, and qualitative approaches to differential equation. Fall 2019, 2020

**Professor, MATH / CSCI 335: Optimization.** Instructed a mix of computer science and mathematics majors on optimization methods including linear optimization, network optimization, and convex optimization. Introduced students to programming languages LINGO and Matlab. Developed a software development-style group project to implement the simplex method in Matlab. Spring 2019

**Professor, MATH 360: Advanced Applied Statistics.** Designed and taught new curriculum for Bayesian data analysis. Guided students through more advanced R coding, Bayesian statistical theory, and hierarchical modeling. Spring 2020

### University of Washington

**Instructor of record, CFRM 410: Probability and Statistics for Computational Finance.** Delivered an overview of probability and statistics techniques need for computational finance to a mixture of online and on-campus students. Employed a unique mastery-based grading scheme that incentivized intensive practice and student excellence. Winter 2018

**Instructor of record, AMATH 301: Beginning Scientific Computing.** Instructed over 400 students on scientific computing using Matlab. Reorganized curriculum to improve clarity and challenge. Coordinated with teaching assistants to maximize consistency and learning outcomes. Fluidly integrated "flipped" lectures into the curriculum. Integrated inclusive historical lessons to motivate material and inspire students of all backgrounds. Spring 2015  
Fall 2016  
Fall 2017

**Instructor of record, CFRM 460: Mathematical Methods for Computational Finance.** Instructed over thirty students, including online students, on mathematical background material needed for pursuing further degrees in computational finance. Developed and gave lectures that were broadcast live and recorded for later viewing. Selected to redesign course curriculum after second year of teaching. Integrated new topics and modified course materials to streamline course and establish suitable challenge level. Winter 2015  
Winter 2016  
Winter 2017

### **Math Science Upward Bound**

**Instructor of record, Machine Learning and Math 5.** Refined and team-taught accelerated AP Statistics course. Designed and team-taught applied mathematics elective on machine learning. Introduced underrepresented high school students to key machine learning and coding techniques.

Summer 2017

**Instructor of record, Study Section and Math 5.** Coordinated ongoing partnership between Upward Bound program and the Department of Applied Mathematics. Led daily study sections for underrepresented high school students seeking to study STEM topics in college. Developed weeklong applied mathematics lab that introduces concepts such as differential equations and phase plots. Planned and taught an accelerated AP Statistics course for highly advanced high school students.

Summer 2017

### **University of Washington High School Summer School**

**Instructor of record, Introduction to Math Modeling.** Developed and taught curriculum for two-week intensive course for advanced high school students in mathematics. Introduced topics such as differential equations, and facilitated mathematical discussions. Hosted guest speakers to discuss the wide range of applications of mathematics.

Summer 2014

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## **Outreach and Service**

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### **University of Puget Sound**

**Data Science Curriculum Development Committee.** Developing proposal to offer a major in Data Science at Puget Sound in collaboration with colleagues from the math and computer science departments.

2020-2021

**Collier Committee.** Read proposals for interdisciplinary research scholarship awards.

2021

**Polar Data in Statistics.** Developed a computational module for Math 160 incorporating data from polar science. In collaboration with Lea Fortmann, Penny Rowe, and Anoushka Adhav (student at University of Washington). Part of PENGUIN - Polar Engagement through Guided Inquiry project.

2020

**Bookends.** Served as Bookends mentor for first-year orientation.

2020

**Summer Academic Session.** Developed interdisciplinary presentation on animal emotion in collaboration with Alexa Tullis and Eli Gandour-Rood. Virtually showcased science and mathematics programs for admitted first-year students.

2020

**Fall Faculty Workshop.** Participated as panelist discussing the use of technology to ease teaching content-rich courses in a virtual environment with other science faculty.

2020

**Student Summer Research Selection.** Read proposals for student summer research in science fields and advised on funding decisions.

2020-Present



<b>Wednesdays@4 Panelist: How do we assess learning in our courses?</b> Shared experience implementing a mastery-based grading framework to a 400 level statistics course for prospective quantitative finance students at the University of Washington.	2019
<b>New Faculty Orientation Panelist.</b> Discussed the academic and Tacoma communities with incoming faculty.	2019
<b>Mathematics Department Seminar: An Honest Talk About Graduate School in Math, CS, and Physics.</b> Spoke as panelist on the process of applying to and attending graduate school in applied mathematics.	2018-2020
<b>Core Curriculum Redesign.</b> Participated in multiple groups brainstorming how to redesign the Core Curriculum. Part of development team for Canopy model.	2019
<b>Curriculum Committee.</b> Oversaw proposals of core courses and new majors amongst other charges from the Faculty Senate.	2019-Present
<b>University of Washington</b>	
<b>Applied Mathematics Teaching Reading Group Founding Leader.</b> Organized a new departmental reading group focusing on mathematics pedagogy. Led discussions about pedagogical literature and facilitated sharing of student teaching techniques and concerns.	2017-2018
<b>BIG Math Networking and Information Session Organizer.</b> Proposed and organized event at which applied mathematics students can network with with local BIG (business, industry, and government) career opportunities. Leveraged personal and alumni networks to draw speakers from a variety of organizations.	2017
<b>Applied Mathematics Department Diversity Committee Founding Member.</b> Collaborated with the administration to represent student interests relating to diversity. Proposed a number of solutions to improve diversity-related outcomes in our department and in the applied mathematics community at large. Successfully applied for grant to fund women's mentorship program.	2017-2018
<b>College Mathematics Instructor Development Source.</b> Organized departmental attendance of online college mathematics pedagogy seminar. Shared teaching concerns and techniques with graduate students and faculty at institutions across the United States.	2016
<b>Society for Industrial and Applied Mathematics, Student Chapter, Treasurer (2013-2014), Vice President (2014-2015), President (2015-2016).</b> Organized weekly chapter meetings to provide valuable seminars and presentations for graduate students.	2013-2016
<b>Math Alliance</b> Member of the Math Alliance, which seeks to support underrepresented students applying to and succeeding in mathematics graduate school. No assigned mentees thus far.	2018-Present