curriculum vitæ of
Rachel C. Kurchin

Assistant Research Professor · Carnegie Mellon University · Materials Science and Engineering · (Physics by courtesy)

🏠 rkurchin.github.io   ✉ rkurchin@cmu.edu   🎓 google scholar   ⚙ github

Education

2014 – 2019	**Ph.D.** Materials Science and Engineering (GPA: 4.6/5.0)	Massachusetts Institute of Technology

Thesis title: "Computational Frameworks to Enable Accelerated Development of Defect-Tolerant Photovoltaic Materials"

2013 – 2014	**MPhil** Materials Science & Metallurgy (research-based)	University of Cambridge
2009 – 2013	**BS** Physics (Intensive) (GPA 3.9/4.0, magna cum laude)	Yale University

Past Research Positions

2019 – 2022	**Postdoctoral Fellow**, Mechanical Engineering, advised by V. Viswanathan	Carnegie Mellon University
2014 – 2019	**PhD student**, Materials Science and Engineering	Massachusetts Institute of Technology

Advised by T. Buonassisi (Mechanical Engineering) (committee members V. Stevanović, B. Yildiz, J. Grossman)

2016 – 2018	**Visiting student**, Solar Energy Research Facility	National Renewable Energy Laboratory

Summer stays advised by V. Stevanović

2013 – 2014	**MPhil student**, Materials Science & Metallurgy	University of Cambridge

Supervised by S. Smoukov, advised by Dame A. Donald (Physics)

2012 – 2013	**Undergraduate researcher**, Physics (senior thesis)	Yale University

Advised by M. L. Lee (Electrical Engineering)

Summer 2012	**REU Student**, Renewable Energy MRSEC, advised by T. Furtak (Physics)	Colorado School of Mines
2012	**Undergraduate researcher**, Physics, advised by C. Osuji (Chemical Engineeing)	Yale University
Summer 2011	**Undergraduate researcher**, Earth and Planetary Sciences	Weizmann Insistute of Science

Advised by I. Koren

Summer 2008	**High school summer researcher**, Laboratory for Laser Energetics	University of Rochester

Advised by R. S. Craxton and M. Wittman

Teaching Experience, Preparation, and Recognition

2023, 2025	**Instructor**	Carnegie Mellon University
	27-100: Engineering the Materials of the Future	
2023	**Instructor**	Carnegie Mellon University
	27-210: Materials Engineering Essentials	
	Guest Lecturer	Carnegie Mellon University
	27-537/27-737: Data Analytics for Materials Science	
2022	**Guest Lecturer**	Carnegie Mellon University
	27-100: Engineering the Materials of the Future	
2021	**Guest Lecturer**	Carnegie Mellon University
	24-643/27-700: Energy Storage Materials and Systems	
	12-216: Introduction to Research Skills in CEE	
2020 – present	**Guest Lecturer**	Carnegie Mellon University
	12-623/24-623: Molecular Simulation of Materials	
2020 – 2023	**Guest Lecturer**	Carnegie Mellon University
	24-786: Bayesian Machine Learning	

2020	**Alum**, Future Faculty Program	CARNEGIE MELLON UNIVERSITY
	Eberly Center for Teaching Excellence	
2019	**Graduate Student Teaching Award**, Mat. Sci. and Eng.	MASSACHUSETTS INSTITUTE OF TECHNOLOGY
	Graduate Student Teaching Award, School of Engineering	MASSACHUSETTS INSTITUTE OF TECHNOLOGY
2018	**Teaching Assistant**	MASSACHUSETTS INSTITUTE OF TECHNOLOGY
	3.23: Electronic, Optical, and Magnetic Properties of Materials	
2011 – 2013	**Science and Quantitative Reasoning Tutor**, Dean's Office	YALE UNIVERSITY

HONORS

2023	Best Oral Presentation, Symposium EN10	MATERIALS RESEARCH SOCIETY FALL MEETING
	PASC Early Career Travel Award	ACM SIGHPC
2022	DCOMP Travel Award	APS DIVISION OF COMPUTATIONAL PHYSICS
	DMP Post-Doctoral Travel Award	APS DIVISION OF MATERIALS PHYSICS
2020	MolSSI Software Fellowship	MOLECULAR SCIENCES SOFTWARE INSTITUTE
	Rising Star in Computational and Data Sciences	ODEN INSTITUTE AT UT AUSTIN
2019	MFI Postdoctoral Fellowship	CMU MANUFACTURING FUTURES INSTITUTE
	CCE Symposium Poster Prize	MIT CENTER FOR COMPUTATIONAL ENGINEERING
2018	Materials Day Best Poster Award	MIT MATERIALS RESEARCH LABORATORY
2017	Blue Waters Graduate Fellowship	NATIONAL CENTER FOR SUPERCOMPUTING APPLICATIONS
2016	Total Energy Fellowship	MIT ENERGY INITIATIVE
	Second Place, De Florez Award Competition	MIT DEPARTMENT OF MECHANICAL ENGINEERING
2014	GRFP Honorable Mention	NATIONAL SCIENCE FOUNDATION
2013	Gates Cambridge Scholarship	CAMBRIDGE GATES TRUST
	Howard L. Schulz Prize	YALE PHYSICS DEPARTMENT
2012	Mellon Grant	PIERSON COLLEGE AT YALE UNIVERSITY
	REMRSEC REU Technical Achievement Award	COLORADO SCHOOL OF MINES RENEWABLE ENERGY MRSEC
2009	Robert C. Byrd Honors Scholarship	US DEPARTMENT OF EDUCATION
	Intel STS Semifinalist	INTEL SCIENCE TALENT SEARCH

RESEARCH SOFTWARE DEVELOPMENT

2021 – present	**Co-Developer**, AtomsBase	GITHUB LINK
	Julia interface for representing atomic structures, currently being used by 310 other Julia packages	
2020 – 2022	**Lead Developer**, ElectrochemicalKinetics	GITHUB LINK
	Julia package for modeling and fitting of electrochemical reaction rate models	
2020 – 2022	**Lead Developer**, Chemellia	GITHUB LINK
	Machine learning ecosystem for atomistic systems in the Julia Language	
2017 – present	**Lead Developer**, Bayesim	GITHUB LINK
	Python package for Bayesian parameter estimation from experimental data using high-throughput simulation	

PUBLICATIONS

Advisees are underlined; authors who equally contributed to a publication are marked with a †.

25. X. Wang, J. A. Loli, Z. W. Ulissi, M. P. de Boer, B. A. Webler, and **R. C. Kurchin**, "Constraint Active Search in Process Window Optimization for Powder Feed Directed Energy Deposition" *Integr. Mater. Manuf. Innov.* (2025)

24. P. Diehl, C. Soneson, **R. C. Kurchin**, R. C. Mounce, and D. S. Katz, "The Journal of Open Source Software (JOSS): Bringing Open-Source Software Practices to the Scholarly Publishing Community for Authors, Reviewers, Editors, and Publishers" *J. Lib. Schol. Comm.* (2025)

23. A. Timmins and **R. C. Kurchin**, "Addressing accuracy by prescribing precision: Bayesian error estimation of point defect energetics" *J. Appl. Phys.* (2024)

22. J. Tang, K. Jiang, P.-S. Tseng, **R. C. Kurchin**, L. M. Porter, and R. F. Davis. "Thermal stability and phase transformation of α-, $\kappa(\epsilon)$-, and γ-Ga_2O_3 films under different ambient conditions" *Appl. Phys. Lett.* (2024)

21. M. Babar, Z. Zhu, **R. C. Kurchin**, E. Kaxiras, and V. Viswanathan. "Twisto-electrochemical activity volcanoes in trilayer graphene" *J. Am. Chem. Soc.* (2024)

20. X. Wang, J. Musielewicz, R. Tran, S. K. Ethirajan, X. Fu, H. Mera, J. R. Kitchin, **R. C. Kurchin**, and Z. W. Ulissi. "Generalization of graph-based active learning relaxation strategies across materials" *Mach. learn.: sci. technol.* (2024)

19. **R. C. Kurchin**, "Using Bayesian parameter estimation to learn more from data without black boxes" *Nat. Rev. Phys.* (2024)

18. **R. C. Kurchin**, D. Gandhi, and V. Viswanathan. "Nonequilibrium Electrochemical Phase Maps: Beyond Butler-Volmer Kinetics" *J. Phys. Chem. Lett.* 14, 7802–7807 (2023)

17. E. Annevelink[†], **R. C. Kurchin**[†], et al. "AutoMat: Automated Materials Discovery for Electrochemical systems." *MRS Bulletin* 47, (2022)

16. A. Mistry, ..., **R. C. Kurchin**, et al. "A minimal information set to enable verifiable theoretical battery research." *ACS Energy Lett.* 6, 11, 3831–3835 (2021)

15. **R. C. Kurchin** and V. Viswanathan. "Marcus-Hush-Chidsey kinetics at electrode-electrolyte interfaces." *J. Chem. Phys.* 153, 134706 (2020)

14. **R. C. Kurchin** et al. "How much physics is in a current-voltage curve? Inferring defect properties from photovoltaic device measurements." *IEEE JPV* 10, 1532–1537 (2020)

13. **R. C. Kurchin**, G. Romano, T. Buonassisi. "Bayesim: a tool for adaptive grid model fitting with Bayesian inference." *Comp. Phys. Comm.* 239, 161-165 (2019)

12. **R. C. Kurchin**[†], P. Gorai[†], Tonio Buonassisi, Vladan Stevanović. "Structural and chemical features giving rise to defect tolerance of binary semiconductors." *Chem. Mater.* 30, 5583–5592 (2018)

11. J. Correa-Baena, L. Nienhaus, **R. C. Kurchin**, et al. "A-site cation in inorganic $A_3Sb_2I_9$ perovskite influences structural dimensionality, exciton binding energy, and solar cell performance." *Chem. Mater.* 30, 3734–3742 (2018)

10. S. S. Shin, J. Correa-Baena, **R. C. Kurchin**, et al. "Solvent-engineering method to deposit compact bismuth-based thin films: mechanism and application to photovoltaics." *Chem. Mater.* 30, 336–343 (2017)

9. R. E. Brandt, **R. C. Kurchin**, et al. "Rapid semiconductor device characterization through Bayesian parameter estimation." *Joule* 1, 843–856 (2017)

8. R. Hoye, L. C. Lee, **R. C. Kurchin**, et al. "Strongly enhanced photovoltaic performance and defect physics of air-stable bismuth oxyiodide (BiOI)" *Adv. Mater.* 29, 1702176 (2017)

7. R. E. Brandt, J. R. Poindexter, P. Gorai, **R. C. Kurchin**, et al. "Searching for "defect-tolerant" photovoltaic materials: combined theoretical and experimental screening." *Chem. Mater.* 29, 4667–4674 (2017)

6. J. R. Poindexter, R. Hoye, L. Nienhaus, **R. C. Kurchin**, et al. "High tolerance to iron contamination in lead halide perovskite solar cells." *ACS Nano* 11, 7101–7109 (2017)

5. R. Hoye, ..., **R. C. Kurchin**, et al. "Perovskite-inspired photovoltaics: best practices in materials characterization and calculations." *Chem. Mater.* 29, 1964–1988 (2016)

4. D. B. Needleman, J. R. Poindexter, **R. C. Kurchin**, et al. "Economically sustainable scaling of photovoltaics to meet climate targets." *Energy Environ. Sci.* 9, 2122–2129 (2016)

3. A. Gufan, ..., **R. C. Kurchin**, et al. "Segmentation and tracking of marine cellular clouds observed by geostationary satellites." *Int. J. Remote Sens.* 37, 1055–1068 (2016)

2. R. Hoye, ..., **R. C. Kurchin**, et al. "Methylammonium bismuth iodide as a lead-free, stable hybrid organic-inorganic solar absorber." *Chem. Eur. J.* 22, 2605–2610 (2015)

1. R. E. Brandt, **R. C. Kurchin**, R. Hoye, et al. "Investigation of bismuth triiodide (BiI_3) for photovoltaic applications." *J. Phys. Chem. Lett.* 6, 4297–4302 (2015)

PRESENTATIONS

INVITED TALKS

| 2025 | *Towards New Workflows in Computational Materials Science with Julia* | FORT WORTH, TX |
| | Society for Industrial and Applied Mathematics Conference on Computational Science and Engineering | |

2024	*Materials Modeling: Bonding across Atoms, Code, and People*	EINDHOVEN, THE NETHERLANDS
	JuliaCon (**keynote**)	
	Using Computation to Accelerate Materials Engineering, from the Atomistic to Device Scale	SEATTLE, WA
	IEEE Photovoltaic Specialists Conference (**plenary**)	
	Overview of Julia Ecosystems for Atomistic Modeling	ZURICH, SWITZERLAND
	Platform for Advanced Scientific Computing (PASC) Conference	
	Learning from Data and Distributions to Accelerate Engineering of Energy Materials and Devices	SEATTLE, WA
	Materials Research Society Spring Meeting	

2023	*Materials Modeling (Data-Driven and Otherwise) in the Julia Language*	VIRTUAL
	NIST Artificial Intelligence for Materials Science Workshop	
	It's All About That Bayes: Data-Driven Insights into Energy Devices without the Black Box	DAVOS, SWITZERLAND
	Platform for Advanced Scientific Computing (PASC) Conference	
	It's All About That Bayes: Data-Driven Insights into Energy Devices without the Black Box	LAS VEGAS, NV
	American Physical Society March Meeting	
	Point Defects in Photovoltaics: From Materials to Devices	EVANSTON, IL
	Snyder Group Meeting, Northwestern University	

2022	*Science Stories with Julia*	PITTSBURGH, PA (VIRTUAL)
	Jordan Group Meeting, University of Pittsburgh	
	Building a Materials Computation Ecosystem in Julia	OTTAWA, CA (VIRTUAL)
	Institute of Data Science, Carleton University	
	Design of Defect-Tolerant Materials for Photovoltaic Applications	CHICAGO, IL
	American Physical Society March Meeting	
	Building a Materials Computation Ecosystem in Julia	CAMBRIDGE, MA (VIRTUAL)
	MIT CESMIX seminar	
	Accelerating Energy Materials Discovery with Computation	BOSTON, MA (VIRTUAL)
	Boston University Department of Materials Science	

2021	*Accelerating Energy Materials Discovery with Computation*	ATLANTA, GA
	Georgia Institute of Technology Department of Materials Science and Engineering	
	Do Me a Solid: Materials Modeling to Fight Climate Change	PITTSBURGH, PA
	Carnegie Mellon University Department of Civil and Environmental Engineering	

| 2020 | *High-Fidelity Accelerated Design of Electrochemical Systems* | ONLINE |
| | Materials Science & Technology Conference | |

Graph Convolutional Networks for Atomic Structures   CAMBRIDGE, UK (VIRTUAL)
Cambridge Machine Learning Discussion Group

Marcus-Hush-Chidsey Kinetics at Solid Surfaces   ONLINE
Battery Modeling Webinar Series

Accelerating Energy Materials Discovery with Computation   NUREMBERG, GERMANY (VIRTUAL)
Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)

Accelerating Energy Materials Discovery with Computation   PITTSBURGH, PA (VIRTUAL)
Carnegie Mellon Department of Materials Science and Engineering

Accelerating Energy Materials Discovery with Computation   URBANA, IL
University of Illinois at Urbana-Champaign Department of Electrical & Computer Engineering

2019   *Bayesim Workshop*   NUREMBERG, GERMANY (VIRTUAL)
Helmholtz Institute for Renewable Energy

2018   *Semiconductor Parameter Extraction (and more!) with Bayesian Inference*   CAMBRIDGE, MA
MIT Society of Industrial and Applied Mathematics

CONTRIBUTED TALKS

2023   *Modeling Electrochemical Reaction Rates at Fluid-Solid Interfaces*   BOSTON, MA
Materials Research Society Fall Meeting

Teaching Introductory Materials Science with Pluto Demos   CAMBRIDGE, MA
JuliaCon

2022   *Non-equilibrium Electrochemical Phase Diagrams with Automatic Differentiation*   CHICAGO, IL
American Physical Society March Meeting

2021   *Introducing Chemellia: Machine Learning, with Atoms*   ONLINE
JuliaCon

Building a Chemistry and Materials Science Ecosystem in Julia   ONLINE
JuliaCon (Birds of a Feather discussion leader)

2018   *Computational Screening for Defect-Tolerant Semiconductors*   NEW LONDON, NH
Gordon Research Seminar on Defects in Semiconductors

Structural and Chemical Features Contributing to Defect Tolerance of Binary Semiconductors   SUNRIVER, OR
Blue Waters Research Symposium

2017   *Toward Quantitative Metrics to Screen for Defect Tolerance in Novel Semiconducting Materials*   BOSTON, MA
Materials Research Society Fall Meeting

2013   *Cross-Sectional EBIC Characterization of III-V Semiconductors for Photovoltaic Applications*   NEW HAVEN, CT
Yale Physics Department

2012   *Improving Active Layer Performance of Hybrid Photovoltaics by Nano Imprinting with Bulk Metallic Glass*   NEW HAVEN, CT
Yale Physics Department

POSTER PRESENTATIONS

2022   *Differentiable Modeling of Electrochemical Reaction Rates*   VENTURA, CA
Gordon Research Seminar/Conference: Batteries

2020   *High-fidelity Accelerated Design of High-performance Electrochemical Systems*   ONLINE
NeurIPS Climate Change and AI Workshop

2019	*Measuring Real-World Quantities from Computer Simulation with Bayesian Inference* MIT de Florez Award Competition	CAMBRIDGE, MA
	Semiconductor Parameter Extraction via Current-Voltage Characterization *and Bayesian Inference Methods* MIT CCE Symposium	CAMBRIDGE, MA
2018	*Semiconductor Parameter Extraction via Current-Voltage Characterization* *and Bayesian Inference Methods* MIT Materials Day	CAMBRIDGE, MA
	Structural and Chemical Features Contributing to Defect Tolerance of Binary Semiconductors Gordon Research Seminar on Defects in Semiconductors	NEW LONDON, NH
	Structural and Chemical Features Contributing to Defect Tolerance of Binary Semiconductors Blue Waters Research Symposium	SUNRIVER, OR
	Semiconductor Parameter Extraction via Current-Voltage Characterization *and Bayesian Inference Methods* World Conference on Photovoltaic Energy Conversion	WAIKOLOA, HI
	Design Principles for Defect-Tolerant Photovoltaic Absorbers MIT de Florez Award Competition	CAMBRIDGE, MA
2016	*Quantitative Metrics for Defect Tolerance in Semiconductors* Materials Research Society Fall Meeting and Exhibit	BOSTON, MA
	Photovoltaics R&D: Thin Film Materials MIT Energy Night	CAMBRIDGE, MA
	Bayes-Sun Inference: Next-Generation Photovoltaics through Advanced Probabilistic Modeling MIT de Florez Award Competition	CAMBRIDGE, MA
	Statistical Inference of Materials Properties from Solar Cell Measurements Beyond 2016: MIT's Frontiers of the Future Symposium	CAMBRIDGE, MA
2015	*Improving the Accuracy of Novel Materials Screening: Growing Defect-Tolerant Photovoltaic Absorbers* MRS Fall Meeting and Exhibit	BOSTON, MA
	Toward Algorithmic Screening of Novel, Defect-Tolerant Solar Materials MIT Materials Day	CAMBRIDGE, MA
	Solar Energy Technology & Innovation in Mexico MIT Energy Initiative Solar Day	CAMBRIDGE, MA
	Toward Algorithmic Screening of Novel, Defect-Tolerant Solar Materials NREL HOPE Workshop	GOLDEN, CO
2013	*Raman Spectroscopy of Silicon Quantum Dots* Northeast Conference for Undergraduate Women in Physics	ITHACA, NY
2012	*Raman Spectroscopy of Silicon Quantum Dots* REMRSEC REU Poster Session	GOLDEN, CO

SERVICE TO THE SCIENTIFIC COMMUNITY

JOURNAL SERVICE

2021 – present	**Editor**	JOURNAL OF OPEN SOURCE SOFTWARE
2020 – present	**Reviewer**	

Matter (1), Phys. Rev. Lett. (1), Comp. Phys. Comm. (1), PRX Energy (1), APL Mach. Learn. (1), J. Phys. Chem. (2), Chem. Mater. (1), J. Phys. Chem. Lett. (1), Phys. Rev. Mater. (6), Comput. Mater. Sci. (1), IEEE J-PV (1), Nat. Comp. Sci. (1), Npj Comput. Mater. (1)

Conference Service: Organization

2024 – present	**Co-chair**, Local Committee	JuliaCon Global
2024 – present	**Invited Organizer**	Electronic Materials Conference
2024	**Lead Organizer**	MolSSI workshop on Julia for Computational Molecular and Materials Science
2019 – 2020	**Organizer**	Pittsburgh Conference for Undergraduate Women in Physics
2015	**Organizer**	Solar Energy Technology & Innovation in Mexico Workshop
2011 – 2012	**Treasurer, Organizer**	Northeast Conference for Undergraduate Women in Physics

Conference Service: Other

2023 – 2025	**Poster Session Judge**	CMU Meeting of the Minds
May 2023	**Technical Presentation Judge**	CMU MSE Graduate Symposium
2023 – 2024	**Poster Session Judge**	CMU Energy Week
March 2022	**Session Chair**	Scientific Machine Learning Webinar Series
March 2022	**Session Chair**, B67: Advanced Approaches in Modeling and Simulation of Defects	APS March Meeting
July 2021	**Session Chair, Volunteer**	JuliaCon
2021 – present	**Reviewer**	JuliaCon
2019	**Reviewer**	NeurIPS ML4PS Workshop
October 2019	**Poster Session Judge**	Pitt Science2019
January 2015	**Panelist**	Northeast Conference for Undergraduate Women in Physics

Leadership and University Service

2023 – present	**Member**, Undergraduate Education Committee	CMU MSE Department
2023 – present	**Member**, Open Science Advisory Board	CMU Libraries
2023 – present	**Design Judge**, Buggy Design Competition	CMU Spring Carnival
October 2023	**Panelist, Mentor**	CMU MSE Rising Stars Workshop
2022 – 2024	**Working Group Chair**, Notebooks Now! Initiative	American Geophysical Union
2018 – 2019	**Member**, Graduate Student Advisory Group for Engineering	MIT School of Engineering
2018 – 2019	**Co-President**, Womxn of Materials Science	MIT DMSE
2017	**Mentor**, Solar Spring Break (service trip)	MIT Energy Initiative
2016 – 2019	**Member**, Energy Education Task Force	MIT Energy Initiative
2016 – 2019	**Member**, Solar Test Bed Steering Committee	MIT Office of Sustainability
2015 – 2017	**Co-Leader**, Solar/Grid Community	MIT Energy Club
2012 – 2013	**Co-Leader**, Project Bright	Yale Office of Sustainability
2012	**Co-President**, Society of Physics Students	Yale Physics Department

Outreach and Other Service

2024 – present	**Teacher**	Leonard Gelfand Center for Service Learning and Outreach at CMU
2024 – present	**Teacher**	Osher Lifelong Learning Institute at CMU
2022 – present	**Mentor**	Prison Mathematics Project
May 2022	**Guest Speaker**	Julia Gender Inclusive
2021 – present	**Volunteer**	Skype a Scientist
2021 – 2022	**Grand Award Judge**, Materials Science Division	Regeneron ISEF
Sumer 2021	**GSoC Mentor**, Julia Language (Chemellia)	Google Summer of Code
March 2014	**Demonstrator**	Cambridge Hands-On Science (CHaOS)

Other Skills and Activities

Foreign Languages

2003 – present	**Spanish**, proficient	
2010 – present	**Hebrew**, intermediate	
2020 – present	**Mandarin**, beginner	

Music: Violinist

2014 – 2019	Chamber Music Society, Gilbert & Sullivan Players, Musical Theater Guild	MIT
2009 – 2013	Jonathan Edwards College Philharmonic, pit orchestras for the Dramat, Gilbert & Sullivan Society, Opera Theatre of Yale College, and various independent productions	Yale

Athletics

2024	**Finisher**, Ironman Chattanooga Relay (cyclist)
2021	**Finisher**, Ironman Maryland
2019, 2021	**Finisher**, Ironman 70.3 Musselman and Pumpkinman Half Iron triathlons
2018 – 2019	**Treasurer**, MIT Triathlon Team
2014, 2018	**Finisher**, Stockholm and Marine Corps Marathons
2013 – 2014	**Rower**, Churchill College Boat Club (1st Women's VIII in May Bumps 2014)
2009 – 2012	**Member** (2009 – 2012), **Treasurer** (2010 – 2011), Yale Bulldog Cycling Team