

curriculum vitae of
Rachel C. Kurchin

ASSISTANT RESEARCH PROFESSOR · CARNEGIE MELLON UNIVERSITY · MATERIALS SCIENCE AND ENGINEERING

rkurchin.github.io rkurchin@cmu.edu [google scholar](https://scholar.google.com/citations?user=...) [github](https://github.com/rkurchin)

EDUCATION

| | | |
|-------------|---|---------------------------------------|
| 2014 – 2019 | Ph.D. Materials Science and Engineering (GPA: 4.6/5.0) Thesis title: “Computational Frameworks to Enable Accelerated Development of Defect-Tolerant Photovoltaic Materials” | MASSACHUSETTS INSTITUTE OF TECHNOLOGY |
| 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 Advised by T. Buonassisi (Mechanical Engineering) (committee members V. Stevanović, B. Yildiz, J. Grossman) | MASSACHUSETTS INSTITUTE OF TECHNOLOGY |
| 2016 – 2018 | Visiting student , Solar Energy Research Facility Summer stays advised by V. Stevanović | NATIONAL RENEWABLE ENERGY LABORATORY |
| 2013 – 2014 | MPhil student , Materials Science & Metallurgy Supervised by S. Smoukov, advised by Dame A. Donald (Physics) | UNIVERSITY OF CAMBRIDGE |
| 2012 – 2013 | Undergraduate researcher , Physics (senior thesis) Advised by M. L. Lee (Electrical Engineering) | YALE UNIVERSITY |
| 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 Engineering) | YALE UNIVERSITY |
| Summer 2011 | Undergraduate researcher , Earth and Planetary Sciences Advised by I. Koren | WEIZMANN INSTITUTE OF SCIENCE |

TEACHING EXPERIENCE, PREPARATION, AND RECOGNITION

| | | |
|-------------|--|--|
| 2023 | Instructor 27-100: Engineering the Materials of the Future 27-210: Materials Engineering Essentials | CARNEGIE MELLON UNIVERSITY |
| | Guest Lecturer 27-537/27-737: Data Analytics for Materials Science 24-786: Bayesian Machine Learning | CARNEGIE MELLON UNIVERSITY |
| 2022 | Guest Lecturer 27-100: Engineering the Materials of the Future 12-623/24-623: Molecular Simulation of Materials | CARNEGIE MELLON UNIVERSITY |
| 2021 | Guest Lecturer 12-623/24-623: Molecular Simulation of Materials 24-643/27-700: Energy Storage Materials and Systems 12-216: Introduction to Research Skills in CEE | CARNEGIE MELLON UNIVERSITY |
| 2020 | Guest Lecturer 12-623/24-623: Molecular Simulation of Materials 24-786: Bayesian Machine Learning (2 lectures) | CARNEGIE MELLON UNIVERSITY |
| | Future Faculty Program Alum , Eberly Center for Teaching Excellence | CARNEGIE MELLON UNIVERSITY |
| 2019 | Graduate Student Teaching Award , Mat. Sci. and Eng. Graduate Student Teaching Award , School of Engineering | MASSACHUSETTS INSTITUTE OF TECHNOLOGY MASSACHUSETTS INSTITUTE OF TECHNOLOGY |
| 2018 | Teaching Assistant 3.23: Electronic, Optical, and Magnetic Properties of Materials | MASSACHUSETTS INSTITUTE OF TECHNOLOGY |
| 2011 – 2013 | Science and Quantitative Reasoning Tutor , Dean’s Office | YALE UNIVERSITY |

HONORS

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|------|--|---|
| 2023 | 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 Julia interface for representing atomic structures, currently being used by >10 other Julia packages | GITHUB LINK |
| 2020 – present | Developer , ElectrochemicalKinetics Julia package for modeling and fitting of electrochemical reaction rate models | GITHUB LINK |
| 2020 – present | Lead Developer , Chemellia Machine learning ecosystem for atomistic systems in the Julia Language | GITHUB LINK |
| 2017 – 2019 | Developer , Bayesim Python package for Bayesian parameter estimation from experimental data using high-throughput simulation | GITHUB LINK |

PUBLICATIONS

Authors who equally contributed to a publication are marked with a †.

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 inter-faces.” *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 (BiI₃) for photovoltaic applications." *J. Phys. Chem. Lett.* **6**, 4297–4302 (2015)

PRESENTATIONS

INVITED TALKS

| | | |
|------|--|--------------------------|
| 2023 | <i>Materials Modeling (Data-Driven and Otherwise) in the Julia Language</i> | VIRTUAL |
| | Artificial Intelligence for Materials Science Workshop | |
| | <i>It's All About That Bayes: Data-Driven Insights into Energy Devices without the Black Box</i> | DAVOS, SWITZERLAND |
| | Platform for Advanced Scientific Computing (PASC) Conference | |
| 2022 | <i>It's All About That Bayes: Data-Driven Insights into Energy Devices without the Black Box</i> | LAS VEGAS, NV |
| | American Physical Society March Meeting | |
| | <i>Point Defects in Photovoltaics: From Materials to Devices</i> | EVANSTON, IL |
| | Snyder Group Meeting, Northwestern University | |
| | <i>Science Stories with Julia</i> | PITTSBURGH, PA (VIRTUAL) |
| | Jordan Group Meeting, University of Pittsburgh | |
| 2021 | <i>Building a Materials Computation Ecosystem in Julia</i> | OTTAWA, CA (VIRTUAL) |
| | Institute of Data Science, Carleton University | |
| | <i>Design of Defect-Tolerant Materials for Photovoltaic Applications</i> | CHICAGO, IL |
| | American Physical Society March Meeting | |
| | <i>Building a Materials Computation Ecosystem in Julia</i> | CAMBRIDGE, MA (VIRTUAL) |
| 2020 | MIT CESMIX seminar | |
| | <i>Accelerating Energy Materials Discovery with Computation</i> | BOSTON, MA (VIRTUAL) |
| | Boston University Materials Science seminar | |
| 2019 | <i>Accelerating Energy Materials Discovery with Computation</i> | ATLANTA, GA |
| | Georgia Institute of Technology Department of Materials Science and Engineering | |

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| | <i>Do Me a Solid: Materials Modeling to Fight Climate Change</i> | PITTSBURGH, PA |
| | Carnegie Mellon University Department of Civil and Environmental Engineering | |
| 2020 | <i>High-Fidelity Accelerated Design of Electrochemical Systems</i> | ONLINE |
| | Materials Science & Technology Conference | |
| | <i>Graph Convolutional Networks for Atomic Structures</i> | CAMBRIDGE, UK (VIRTUAL) |
| | Cambridge Machine Learning Discussion Group | |
| | <i>Marcus-Hush-Chidsey Kinetics at Solid Surfaces</i> | ONLINE |
| | Battery Modeling Webinar Series | |
| | <i>Accelerating Energy Materials Discovery with Computation</i> | NUREMBERG, GERMANY (VIRTUAL) |
| | Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) | |
| | <i>Accelerating Energy Materials Discovery with Computation</i> | PITTSBURGH, PA (VIRTUAL) |
| | Carnegie Mellon Department of Materials Science and Engineering | |
| | <i>Accelerating Energy Materials Discovery with Computation</i> | URBANA, IL |
| | University of Illinois at Urbana-Champaign Department of Electrical & Computer Engineering | |
| 2019 | <i>Bayesim Workshop</i> | NUREMBERG, GERMANY (VIRTUAL) |
| | Helmholtz Institute for Renewable Energy | |
| 2018 | <i>Semiconductor Parameter Extraction (and more!) with Bayesian Inference</i> | CAMBRIDGE, MA |
| | MIT Society of Industrial and Applied Mathematics | |
| | CONTRIBUTED TALKS | |
| 2023 | <i>Teaching Introductory Materials Science with Pluto Demos</i> | CAMBRIDGE, MA |
| | JuliaCon | |
| 2022 | <i>Non-equilibrium Electrochemical Phase Diagrams with Automatic Differentiation</i> | CHICAGO, IL |
| | American Physical Society March Meeting | |
| 2021 | <i>Introducing Chemellia: Machine Learning, with Atoms</i> | ONLINE |
| | JuliaCon | |
| | <i>Building a Chemistry and Materials Science Ecosystem in Julia</i> | ONLINE |
| | JuliaCon (Birds of a Feather discussion leader) | |
| 2018 | <i>Computational Screening for Defect-Tolerant Semiconductors</i> | NEW LONDON, NH |
| | Gordon Research Seminar on Defects in Semiconductors | |
| | <i>Structural and Chemical Features Contributing to Defect Tolerance of Binary Semiconductors</i> | SUNRIVER, OR |
| | Blue Waters Research Symposium | |
| 2017 | <i>Toward Quantitative Metrics to Screen for Defect Tolerance in Novel Semiconducting Materials</i> | BOSTON, MA |
| | Materials Research Society Fall Meeting and Exhibit | |
| 2013 | <i>Cross-Sectional EBIC Characterization of III-V Semiconductors for Photovoltaic Applications</i> | NEW HAVEN, CT |
| | Yale Physics Department | |
| 2012 | <i>Improving Active Layer Performance of Hybrid Photovoltaics by Nano Imprinting with Bulk Metallic Glass</i> | NEW HAVEN, CT |
| | Yale Physics Department | |
| | POSTER PRESENTATIONS | |
| 2022 | <i>Differentiable Modeling of Electrochemical Reaction Rates</i> | VENTURA, CA |
| | Gordon Research Seminar/Conference: Batteries | |
| 2020 | <i>High-fidelity Accelerated Design of High-performance Electrochemical Systems</i> | ONLINE |
| | NeurIPS Climate Change and AI Workshop | |
| 2019 | <i>Measuring Real-World Quantities from Computer Simulation with Bayesian Inference</i> | CAMBRIDGE, MA |
| | MIT de Florez Award Competition | |

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

SERVICE TO THE SCIENTIFIC COMMUNITY

JOURNAL EDITING

2021 – present Journal of Open-Source Software

JOURNAL REVIEWING

2022 – present Computer Physics Communications, APL Machine Learning
Journal of Physical Chemistry, Chemistry of Materials, Journal of Physical Chemistry Letters, PR Materials,
2021 – present Computational Materials Science, IEEE Journal of Photovoltaics, Nature Computational Science
2020 – present NPJ Computational Materials
2019 – present Applied Energy Materials
2017 – present Energy & Environmental Science

CONFERENCE SERVICE

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| May 2023 | Technical Presentation Judge | CMU MSE GRADUATE SYMPOSIUM |
| March 2023 | 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 – 2020 | Organizer | PITTSBURGH CONFERENCE FOR UNDERGRADUATE WOMEN IN PHYSICS |
| 2019 | Reviewer | NEURIPS ML4PS WORKSHOP |
| October 2019 | Poster Session Judge | PITT SCIENCE2019 |
| 2015 | Organizer | SOLAR ENERGY TECHNOLOGY & INNOVATION IN MEXICO WORKSHOP |
| January 2015 | Panelist | NORTHEAST CONFERENCE FOR UNDERGRADUATE WOMEN IN PHYSICS |
| 2011 – 2012 | Organizer | NORTHEAST CONFERENCE FOR UNDERGRADUATE WOMEN IN PHYSICS |

LEADERSHIP/OUTREACH

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|----------------|--|---|
| April 2023 | Design Judge | CMU BUGGY DESIGN COMPETITION |
| 2022 – present | Working Group Chair | NOTEBOOKS NOW! INITIATIVE |
| 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 |
| Summer 2021 | GSoC Mentor , Julia Language (Chemellia) | GOOGLE SUMMER OF CODE |
| 2018 – 2019 | Member , Advisor-Advisee Relations Subcommittee | MIT GRAD STUDENT ADVISORY GROUP FOR ENGINEERING |
| 2018 – 2019 | Co-President | MIT WOMEN OF MATERIALS SCIENCE |
| 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 |
| March 2014 | Demonstrator | CAMBRIDGE HANDS-ON SCIENCE (CHAOS) |
| 2012 – 2013 | Co-Leader , Project Bright | YALE OFFICE OF SUSTAINABILITY |
| 2012 | Co-President , Society of Physics Students | YALE PHYSICS DEPARTMENT |

OTHER SKILLS AND ACTIVITIES

FOREIGN LANGUAGES

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

MUSIC: VIOLINIST

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| 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

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| 2021 | Finisher , Ironman Maryland and Ironman 70.3 Musselman triathlons |
| 2019 | Finisher , Pumpkinman Half Iron Triathlon |
| 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 |