# Rachel C. Kurchin

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Pittsburgh, PA

rkurchin@cmu.edu
rkurchin.github.io

## EDUCATION

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|---|---|
| 2019 | **Massachusetts Institute of Technology** *Cambridge, MA, USA* <br> Ph.D., Materials Science and Engineering, GPA 4.6/5.0 |
| 2014 | **University of Cambridge** *Cambridgeshire, UK* <br> MPhil, Materials Science & Metallurgy (research-based) |
| 2013 | **Yale University** *New Haven, CT, USA* <br> B.S., Physics (Intensive), with distinction (magna cum laude, GPA 3.9/4.0) |

## RESEARCH POSITIONS

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| 2019 – pres. | **Carnegie Mellon University** *Mechanical Engineering, Materials Science and Engineering* <br> MFI ('19-'20), MolSSI ('21) Postdoctoral Fellow with Venkat Viswanathan and Jay Whitacre |
| 2014 – 2019 | **Massachusetts Institute of Technology** *Mechanical Engineering* <br> Ph.D. student with Tonio Buonassisi (committee: V. Stevanović, J. Grossman, B. Yildiz) |
| 2016 – 2017 | **National Renewable Energy Laboratory** *Solar Energy Research Facility* <br> Summer Visiting Graduate Student with Vladan Stevanović |
| 2013 – 2014 | **University of Cambridge** *Materials Science & Metallurgy* <br> Master's Student with Stoyan Smoukov, advised by Dame Athene Donald |
| 2012 – 2013 | **Yale University** *Electrical Engineering* <br> Undergraduate researcher (senior thesis) with Minjoo Larry Lee |
| 2012 | **Colorado School of Mines** *Physics* <br> REMRSEC REU Student with Thomas Furtak |
| 2012 | **Yale University** *Chemical Engineering* <br> Undergraduate researcher with Chinedum Osuji |
| 2011 | **Weizmann Institute of Science** *Earth and Planetary Sciences* <br> Undergraduate summer researcher with Ilan Koren |
| 2008 | **University of Rochester** *Laboratory for Laser Energetics* <br> High school summer researcher with R. Stephen Craxton |

## TEACHING EXPERIENCE, PREPARATION, AND RECOGNITION

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| 2021 | **Guest lecturer** *CMU Courses 12-623/24-623: Molecular Simulation of Materials* <br> *24-643/27-700: Energy Storage Materials and Systems* |
| 2020 | **Guest lecturer** *CMU Courses 12-623/24-623: Molecular Simulation of Materials* <br> *24-786: Bayesian Machine Learning (2 lectures)* <br> **Future Faculty Program** *CMU Eberly Center for Teaching Excellence* |
| 2019 | **Graduate Student Teaching Award** *MIT Department of Materials Science and Engineering* <br> **Graduate Student Teaching Award** *MIT School of Engineering* |
| 2018 | **Teaching Assistant** *MIT Dept. of Materials Science and Engineering* <br> 3.23: Electronic, Optical, and Magnetic Properties of Materials |
| 2011 – 2013 | **Science and Quantitative Reasoning Tutor** *Yale University Dean's Office* |

## FELLOWSHIPS AND AWARDS

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|---|---|
| 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 Initiative* |
| | **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 Dept. of Mechanical Engineering* |
| 2014 | **GRFP Honorable Mention** *National Science Foundation* |
| 2013 | **Gates Cambridge Scholarship** *Cambridge Gates Trust* |
| | **Howard L. Schultz Prize** *Yale Physics Department* |
| 2012 | **Mellon Grant** *Pierson College at Yale University* |
| | **REMRSEC REU Technical Achievement Award** *Colorado School of Mines Renewable Energy Materials Research Science and Engineering Center* |
| 2009 | **Robert C. Byrd Honors Scholarship** *US Department of Education* |
| | **Intel STS Semifinalist** *Intel Science Talent Search* |

## PUBLICATIONS ([Google Scholar](#))

| | | |
|---|---|---|
| 2021 | [16] | A. Mistry, A. Verma, S. Sripad, R. Ciez, V. Sulzer, F. Brosa Planella, R. Timms, Y. Zhang, **R. Kurchin**, et al. "A minimal information set to enable verifiable theoretical battery research." *ACS Energy Letters* 3831–3835 (2021) |
| 2020 | [15] | **R. Kurchin**, V. Viswanathan. "Marcus-Hush-Chidsey kinetics at electrode-electrolyte interfaces." *The Journal of Chemical Physics* 153, 134706 (2020) |
| | [14] | **R. C. Kurchin**, J. R. Poindexter, V. Vahanissi, et al. "How much physics is in a current-voltage curve? Inferring defect properties from photovoltaic device measurements." *IEEE Journal of Photovoltaics* 10, 1532–1537 (2020) |
| 2019 | [13] | **R. C. Kurchin**, G. Romano, T. Buonassisi. "Bayesim: a tool for adaptive grid model fitting with Bayesian inference." *Computer Physics Communications* 239, 161–165 (2019) |
| 2018 | [12] | **R. C. Kurchin**, P. Gorai, T. Buonassisi, V. Stevanović. "Structural and chemical features giving rise to defect tolerance of binary semiconductors." *Chemistry of Materials* 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." *Chemistry of Materials* 30, 3734–3742 (2018) |
| 2017 | [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." *Chemistry of Materials* 30, 336–343 (2017) |
| | [09] | R. Brandt, **R. C. Kurchin**, V. Steinmann, et al. "Rapid semiconductor device characterization through Bayesian parameter estimation." *Joule* 1, 843–856 (2017) |

[08] R. Hoye, L. C. Lee, **R. C. Kurchin**, et al. "Strongly enhanced photovoltaic performance and defect physics of air-stable bismuth oxyiodide (BiOI)." *Advanced Materials* 29, (2017)

[07] R. E. Brandt, J. Poindexter, P. Gorai, **R. Kurchin**, et al. "Searching for "defect-tolerant" photovoltaic materials: combined theoretical and experimental screening." *Chemistry of Materials* 29, 4667–4674 (2017)

[06] 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)

2016 [05] R. Hoye, P. Schulz, L. T. Schelhas, A. M. Holder, K. H. Stone, J. D. Perkins, D. Vigil-Fowler, S. Siol, D. O. Scanlon, A. Zakutayev, A. Walsh, I. C. Smith, B. C. Melot, **R. C. Kurchin**, et al. "Perovskite-inspired photovoltaics: best practices in materials characterization and calculations." *Chemistry of Materials* 29, 1964–1988 (2016)

[04] D. B. Needleman, J. R. Poindexter, **R. C. Kurchin**, et al. "Economically sustainable scaling of photovoltaics to meet climate targets." *Energy & Environmental Science* 9, 2122–2129 (2016)

[03] A. Gufan, Y. Lehahn, E. Fredj, C. Price, **R. C. Kurchin**, et al. "Segmentation and tracking of marine cellular clouds observed by geostationary satellites." *International Journal of Remote Sensing* 37, 1055–1068 (2016)

2015 [02] R. Hoye, R. E. Brandt, A. Osherov, V. Stevanović, S. D. Stranks, M. Wilson, H. Kim, A. J. Akey, **R. C. Kurchin**, et al. "Methylammonium bismuth iodide as a lead-free, stable hybrid organic-inorganic solar absorber." *Chemistry - A European Journal* 22, 2605–2610 (2015)

[01] R. E. Brandt, **R. C. Kurchin**, R. Hoye, et al. "Investigation of bismuth triiodide (BiI$_3$) for photovoltaic applications." *The Journal of Physical Chemistry Letters* 6, 4297–4302 (2015)

## INVITED TALKS

| 2022 | *Role of Defects in Photovoltaic Materials*<br>APS March Meeting, Chicago, IL |
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| 2021 | *Do Me a Solid: Materials Modeling to Fight Climate Change*<br>Carnegie Mellon Department of Civil and Environmental Engineering, Pittsburgh, PA |
| 2020 | *High-fidelity Accelerated Design of High-performance Electrochemical Systems*<br>Materials Science & Technology Conference, online |
| | *Graph Convolutional Networks for Atomic Structures*<br>Seminar Cambridge Machine Learning Discussion Group, Cambridge, UK |
| | *Marcus-Hush-Chidsey Kinetics at Solid Surfaces*<br>Battery Modeling Webinar Series, online |
| | *Accelerating Energy Materials Discovery with Computation*<br>Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), virtually in Nuremberg, Germany |
| | *Accelerating Energy Materials Discovery with Computation*<br>Carnegie Mellon University Materials Science and Engineering Department, online |
| | *Accelerating Energy Materials Discovery with Computation*<br>UIUC Electrical & Computer Engineering Department, Urbana, IL |
| 2019 | *Bayesim Workshop*<br>Helmholtz Institute for Renewable Energy, virtually in Nuremberg, Germany |
| 2018 | *Semiconductor Parameter Extraction (and more!) with Bayesian Inference*<br>MIT Society of Industrial and Applied Mathematics, Cambridge, MA |

## CONTRIBUTED TALKS

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

        *Building a Chemistry and Materials Science Ecosystem in Julia*
        JuliaCon, online

2018    *Computational Screening for Defect-Tolerant 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

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

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

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

## POSTER PRESENTATIONS

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

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*
        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    *Toward Algorithmic Screening of Novel, Defect-Tolerant Solar Materials*
        MIT Materials Day, Cambridge, MA

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| | *Solar Energy Technology & Innovation in Mexico* <br> MIT Energy Initiative Solar Day, Cambridge, MA |
| | *Toward Algorithmic Screening of Novel, Defect-Tolerant Solar Materials* <br> NREL HOPE workshop, Golden, CO |
| 2013 | *Raman Spectroscopy of Silicon Quntum Dots* <br> Northeast Conference for Undergraduate Women in Physics, Ithaca, NY |
| 2012 | *Raman Spectroscopy of Silicon Quntum Dots* <br> REMRSEC REU Poster Session, Golden, CO |

## REVIEWING/EDITING

<u>Editor</u>

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| since 2021 | **Journal of Open-Source Software** *Open Journals* |

<u>Reviewer</u>

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| since 2021 | **Chemistry of Materials** *Americal Chemical Society* |
| | **Journal of Physical Chemistry Letters** *American Chemical Society* |
| | **PR Materials** *Physical Review Journals* |
| | **JuliaCon** |
| | **Computational Materials Science** *Elsevier* |
| | **Journal of Photovoltaics** *IEEE* |
| | **Nature Computational Science** *Springer Nature* |
| since 2020 | **NPJ Computational Materials** *Springer Nature* |
| 2019 | **NeurIPS ML4PS Workshop** |
| since 2019 | **Applied Energy Materials** *American Chemical Society* |
| since 2017 | **Energy & Environmental Science** *Royal Society of Chemistry* |

## SERVICE

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| July 2021 | **Session Chair, Volunteer** *JuliaCon* |
| 2021 – present | **Grand Award Judge** *Regeneron ISEF* |
| 2019 – 2020 | **Conference Organizer** *Pittsburgh Conference for Undergraduate Women in Physics* |
| 2018 – 2019 | **Graduate Student Advisory Group for Engineering** *MIT School of Engineering* |
| 2018 – 2019 | **Co-President, Women of Materials Science** *MIT Department of Materials Science* |
| Spring 2017 | **Graduate Student Mentor, Solar Spring Break** *MIT Energy Initiative* |
| 2016 – 2019 | **Energy Education Task Force** *MIT Energy Initiative* |
| 2016 – 2019 | **Solar Test Bed Steering Committee** *MIT Office of Sustainability* |
| 2015 | **Conference Organizer** *Solar Energy Technology & Innovation in Mexico Workshop* |
| 2015 – 2017 | **Solar/Grid Community Co-Leader** *MIT Energy Club* |
| January 2015 | **Graduate Student Panelist** *Northeast Conference for Undergraduate Women in Physics* |
| March 2014 | **Science Demonstrator** *Cambridge Hands-On Science* |
| 2012 – 2013 | **Project Bright Co-Leader** *Yale University* |
| 2012 | **SPS Co-President** *Yale Society of Physics Students* |
| 2011 – 2012 | **Conference Organizer** *Northeast Conference for Undergraduate Women in Physics* |

## COMPUTATIONAL SKILLS

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| *Simulation* | VASP, GPAW, PC1D, SCAPS-1D |
| Languages | Julia, Python, Matlab, Mathematica, LaTeX, bash |
| *HPC* | Have earned allocations and used systems at national labs, NSF facilities, and universities |
| *Software Development* | Git, GitHub, open-source package development and maintenance in Julia and Python incl. CI, docs, issues/PR's, etc. |

## OTHER SKILLS AND ACTIVITIES

### Foreign Languages

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| Spanish | Proficient |
| Hebrew | Intermediate |

### Music – Violinist

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

### 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), Manager (2010 – 2011), Yale Bulldog Cycling Team |