Rachel C. Kurchin

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EDUCATION

2019 **Massachusetts Institute of Technology** *Cambridge, MA, USA*
Ph.D., Materials Science and Engineering, GPA 4.6/5.0

2014 **University of Cambridge** *Cambridgeshire, UK*
MPhil, Materials Science & Metallurgy (research-based)

2013 **Yale University** *New Haven, CT, USA*
B.S., Physics (Intensive), with distinction (magna cum laude, GPA 3.9/4.0)

RESEARCH POSITIONS

2019 – pres. **Carnegie Mellon University** *Mechanical Engineering, Materials Science and Engineering*
MFI ('19-'20), MolSSI ('21) Postdoctoral Fellow with Venkat Viswanathan and Jay Whitacre

2014 – 2019 **Massachusetts Institute of Technology** *Mechanical Engineering*
Ph.D. student with Tonio Buonassisi (committee: V. Stevanović, J. Grossman, B. Yildiz)

2016 – 2017 **National Renewable Energy Laboratory** *Solar Energy Research Facility*
Summer Visiting Graduate Student with Vladan Stevanović

2013 – 2014 **University of Cambridge** *Materials Science & Metallurgy*
Master's Student with Stoyan Smoukov, advised by Dame Athene Donald

2012 – 2013 **Yale University** *Electrical Engineering*
Undergraduate researcher (senior thesis) with Minjoo Larry Lee

2012 **Colorado School of Mines** *Physics*
REMRSEC REU Student with Thomas Furtak

2012 **Yale University** *Chemical Engineering*
Undergraduate researcher with Chinedum Osuji

2011 **Weizmann Institute of Science** *Earth and Planetary Sciences*
Undergraduate summer researcher with Ilan Koren

2008 **University of Rochester** *Laboratory for Laser Energetics*
High school summer researcher with R. Stephen Craxton

TEACHING EXPERIENCE, PREPARATION, AND RECOGNITION

2021 **Guest lecturer** *CMU Courses 12-623/24-623: Molecular Simulation of Materials*
24-643/27-700: Energy Storage Materials and Systems

2020 **Guest lecturer** *CMU Courses 12-623/24-623: Molecular Simulation of Materials*
24-786: Bayesian Machine Learning (2 lectures)

Future Faculty Program *CMU Eberly Center for Teaching Excellence*

2019 **Graduate Student Teaching Award** *MIT Department of Materials Science and Engineering*

Graduate Student Teaching Award *MIT School of Engineering*

2018 **Teaching Assistant** *MIT Dept. of Materials Science and Engineering*
3.23: Electronic, Optical, and Magnetic Properties of Materials

2011 – 2013 **Science and Quantitative Reasoning Tutor** *Yale University Dean's Office*

FELLOWSHIPS AND AWARDS

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)

TALKS

2021 *Do Me a Solid: Materials Modeling to Fight Climate Change*
Carnegie Mellon Department of Civil and Environmental Engineering

Introducing Chemellia: Machine Learning, with Atoms
JuliaCon

Building a Chemistry and Materials Science Ecosystem in Julia
JuliaCon

2020 *High-fidelity Accelerated Design of High-performance Electrochemical Systems*
Materials Science & Technology Conference 2020

Graph Convolutional Networks for Atomic Structures
Cambridge Machine Learning Discussion Group

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

Accelerating Energy Materials Discovery with Computation
Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)

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

2019 *Bayesim Workshop*
Helmholtz Institute for Renewable Energy Erlangen Nuremberg

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

Computational Screening for Defect-Tolerant Semiconductors
Gordon Research Seminar on Defects in Semiconductors

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

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

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

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

POSTER PRESENTATIONS

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

2019 *Measuring Real-World Quantities from Computer Simulation with Bayesian Inference*
MIT de Florez Award Competition

Semiconductor Parameter Extraction via Current-Voltage Characterization and Bayesian Inference Methods
MIT CCE Symposium

2018 *Semiconductor Parameter Extraction via Current-Voltage Characterization and Bayesian Inference Methods*
MIT Materials Day

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

Semiconductor Parameter Extraction via Current-Voltage Characterization and Bayesian Inference Methods
World Conference on Photovoltaic Energy Conversion

Design Principles for Defect-Tolerant Photovoltaic Absorbers
MIT de Florez Award Competition

2016 *Quantitative Metrics for Defect Tolerance in Semiconductors*
Materials Research Society Fall Meeting and Exhibit

Photovoltaics R&D: Thin Film Materials
MIT Energy Night

Bayes-Sun Inference: Next-Generation Photovoltaics through Advanced Probabilistic Modeling
MIT de Florez Award Competition

Statistical Inference of Materials Properties from Solar Cell Measurements
Beyond 2016: MIT's Frontiers of the Future Symposium

2015 *Toward Algorithmic Screening of Novel, Defect-Tolerant Solar Materials*
MIT Materials Day

Solar Energy Technology & Innovation in Mexico
MIT Energy Initiative Solar Day

Toward Algorithmic Screening of Novel, Defect-Tolerant Solar Materials
NREL HOPE workshop

2013 *Raman Spectroscopy of Silicon Quntum Dots*
Northeast Conference for Undergraduate Women in Physics

2012 *Raman Spectroscopy of Silicon Quntum Dots*
REMRSEC REU Poster Session

REVIEWING/EDITING

Editor

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

Reviewer

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

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

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

Spanish	Proficient
Hebrew	Intermediate

Music – Violinist

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

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