

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** *Depts. of 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** *Dept. of 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** *Dept. of Materials Science & Metallurgy*
Master's Student with Stoyan Smoukov, advised by Dame Athene Donald
- 2012 – 2013 **Yale University** *Dept. of Electrical Engineering*
Undergraduate researcher (senior thesis) with Minjoo Larry Lee
- 2012 **Colorado School of Mines** *Dept. of Physics*
Summer REU Student with Thomas Furtak
- 2012 **Yale University** *Dept. of Chemical Engineering*
Undergraduate researcher with Chinedum Osuji
- 2011 **Weizmann Institute of Science** *Dept. of 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

- 2020 **Guest lecture** *CMU Course 12-623/24-623: Molecular Simulation of Materials*
Future Faculty Program *CMU Eberly Center for Teaching Excellence*
Guest lectures *CMU Course 24-786: Bayesian Machine Learning*
- 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*
TA 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 <i>Molecular Sciences Software Institute</i> Rising Star in Computational and Data Sciences <i>Oden Institute at UT Austin</i>
2019	MFI Postdoctoral Fellowship <i>CMU Manufacturing Futures Initiative</i> CCE Symposium Poster Prize <i>MIT Center for Computational Engineering</i>
2018	Materials Day Best Poster Award <i>MIT Materials Research Laboratory</i>
2017	Blue Waters Graduate Fellowship <i>National Center for Supercomputing Applications</i>
2016	Total Energy Fellowship <i>MIT Energy Initiative</i> Second Place, de Florez Award Competition <i>MIT Dept. of Mechanical Engineering</i>
2014	GRFP Honorable Mention <i>National Science Foundation</i>
2013	Gates Cambridge Scholarship <i>Cambridge Gates Trust</i> Howard L. Schultz Prize <i>Yale Physics Department</i>
2012	Mellon Grant <i>Pierson College at Yale University</i> REMRSEC REU Technical Achievement Award <i>Colorado School of Mines Renewable Energy Materials Research Science and Engineering Center</i>
2009	Robert C. Byrd Honors Scholarship <i>US Department of Education</i> Intel STS Semifinalist <i>Intel Science Talent Search</i>

PUBLICATIONS

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.” <i>ACS Energy Letters</i> 3831–3835 (2021)
2020	[15]	R. Kurchin , V. Viswanathan. “Marcus-Hush-Chidsey kinetics at electrode-electrolyte interfaces.” <i>The Journal of Chemical Physics</i> 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.” <i>IEEE Journal of Photovoltaics</i> 10, 1532–1537 (2020)
2019	[13]	R. C. Kurchin , G. Romano, T. Buonassisi. “Bayesim: a tool for adaptive grid model fitting with Bayesian inference.” <i>Computer Physics Communications</i> 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.” <i>Chemistry of Materials</i> 30, 5583–5592 (2018)
	[11]	J. Correa-Baena, L. Nienhaus, R. C. Kurchin , et al. “A-site cation in inorganic $\text{A}_3\text{Sb}_2\text{I}_9$ perovskite influences structural dimensionality, exciton binding energy, and solar cell performance.” <i>Chemistry of Materials</i> 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.” <i>Chemistry of Materials</i> 30, 336–343 (2017)
	[09]	R. Brandt, R. C. Kurchin , V. Steinmann, et al. “Rapid semiconductor device characterization through Bayesian parameter estimation.” <i>Joule</i> 1, 843–856 (2017)

- [08] R. Hoyer, 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. Hoyer, 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. Hoyer, 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. Hoyer, 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. Hoyer, et al. “Investigation of bismuth triiodide (BiI₃) for photovoltaic applications.” *The Journal of Physical Chemistry Letters* 6, 4297–4302 (2015)

TALKS

- 2021 *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 Quantum Dots*
Northeast Conference for Undergraduate Women in Physics
- 2012 *Raman Spectroscopy of Silicon Quantum Dots*
REMRSEC REU Poster Session

REVIEWING/EDITING

Editor

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

Reviewer

since 2021 **Chemistry of Materials** *American 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, L^AT_EX, 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

2019, 2021 Finisher, Pumpkinman Half Iron and Ironman 70.3 Musselman 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), Manager (2010 – 2011), Yale Bulldog Cycling Team