

RACHEL N. SLAYBAUGH

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Department of Nuclear Engineering ◊ University of California, Berkeley
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EDUCATION

Ph.D.	University of Wisconsin–Madison Nuclear Engineering and Engineering Physics, with a certificate in Energy Analysis and Policy	2011
M.S.	University of Wisconsin–Madison Nuclear Engineering and Engineering Physics	2008
B.S.	Pennsylvania State University Nuclear Engineering	2006

RESEARCH EXPERIENCE

University of California, Berkeley <i>Assistant Professor of Nuclear Engineering</i>	Jan. 2014 – Present <i>Berkeley, CA</i>
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- Researching numerical methods for neutral particle transport with an emphasis on supercomputing and advanced architectures as well as data science
- Specialization in deterministic, Monte Carlo, and hybrid methods
- Applications in reactor design, shielding, and nuclear security and nonproliferation
- Design Emphasis in Computational Science and Engineering Affiliated Faculty member
- Applied Science & Technology Faculty member

Advanced Research Projects Agency – Energy <i>Special Gov Employee / Program Director / Senior Technical Advisor</i>	Jan. 2017 – Dec. 2020 <i>Washington, DC</i>
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- Program creation and management
Special Government Employee Jan. 2017 – Oct. 2017 and Special Advisor Aug. 2020 – Dec. 2020
- Director for MEITNER, the Nuclear OPEN+ cohort, LISE, and GEMINA Programs, supporting research for enabling technologies for advanced nuclear fission reactors
- Co-Director for TERRA and ROOTS Programs, supporting research for sensing and data analytics for above- and below-ground plant outcomes
- Director for FOCUS Program, supporting research for solar technologies that combine photovoltaic and concentrated solar power technologies

Bettis Laboratory <i>Senior Engineer in the Shield Design and Development group</i>	Mar. 2012 – Aug. 2014 <i>West Mifflin, PA</i>
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- Implemented the Forward-Weighted Consistent Adjoint Driven Importance Sampling (FW-CADIS) method for variance reduction in Monte Carlo; accredited method for use in shield design
- Developed new Resonance Factor variance reduction method for streaming through materials with space and energy self-shielding
- Built two software tools in support of using FW-CADIS for shield design
- Scientific Software Development Committee: leader in developing internal website for sharing software carpentry tools and resources

University of Wisconsin–Madison*Research Assistant / Rickover Fellow*

Sept. 2006 – Nov. 2011

Madison, WI

- Researched “Acceleration Methods for Massively Parallel Deterministic Transport”: added parallelization in the energy domain, an advanced eigenvalue solver, and a new multigrid in energy preconditioner to Denovo, developed at Oak Ridge National Lab
- Developed two Monte Carlo source sampling methods for arbitrarily shaped plasma sources; the sources are generated directly from plasma physics data

Forschungszentrum Karlsruhe (KIT)*Visiting Researcher*

May 2008 – Dec. 2008

Karlsruhe, Germany

- Learned about the Rigorous 2 Step method for Monte Carlo geometry conversion while working in the Reactor Safety group
- Helped group incorporate the Direct Accelerated Geometry Monte Carlo (DAGMC) library into MCNP workflow

Penn State Breazeale Reactor*Reactor Operator*

Aug. 2003 – Apr. 2006

University Park, PA

- NRC licensed Reactor Operator for TRIGA Mark III reactor
- Analyzed core burn-up anomaly; calibrated gamma irradiation facilities

TEACHING EXPERIENCE

University of California, Berkeley*Assistant Professor of Nuclear Engineering*

Jan. 2014 - Present

Berkeley, CA

- Founder Nuclear Innovation Bootcamp, summers 2016 - 2019
- NE 250, Nuclear Reactor Theory (graduate-level): Fall 2015, 2017
- NE 255, Numerical Simulations for Radiation Transport (graduate-level): Fall 2016
- NE 155, Introduction to Numerical Simulations for Radiation Transport (senior-level elective): Spring 2014, 2015, 2016, 2017
- NE 198, Faculty sponsor for class in which Berkeley students do hands-on science experiments with students in under-served elementary schools in Oakland: Fall 2015 - present
- NE 24, Putting the Science in Computational Science (Freshman seminar), Spring 2015, 2016, 2017

Software Carpentry Scientific Computing Workshops*Instructor*

- Jan. 14-15, 2016: git; Berkeley Institute for Data Science
- July 16, 2015: shell; École Polytechnique Fédérale Lausanne
- July 1-2, 2015: shell and Python; for underrepresented minority students; UC, Berkeley
- June 11, 2015: Python; Oak Ridge National Laboratory
- Jan. 5-6, 2015: version control; for women only; University of Colorado, Boulder
- Apr. 14-15, 2014: introductory material, version control, object oriented concepts in Python; for women only; Lawrence Berkeley National Laboratory

Bettis Laboratory*Senior Engineer in the Shield Design and Development group*

Mar. 2012 - Aug. 2014

West Mifflin, PA

- Qualified instructor for Bettis Reactor Engineering School (BRES), an internal school for new DOE-Naval Reactors employees
- Co-taught BRES Shielding course Fall 2012, 2013, and Spring 2013

- Co-taught Introduction to Nuclear Engineering (ENGR 1700), which covers theory / basic nuclear engineering, basics of nuclear power reactors, and nuclear power reactor operations Fall 2012
- Co-taught *new* course Nuclear Chemistry and Radiochemistry (ENGR 2112), responsible for nuclear astrophysics and migration of radionuclides through the environment Spring 2013

SELECTED PRESENTATIONS

- R.N. Slaybaugh. “How Can Nuclear Be Part of a Clean Energy Future?.” Breakthrough Generation Bootcamp. Online. 18 June 2020. (invited)
- R.N. Slaybaugh. Panelist for “Challenges and Opportunities in Thermal Hydraulics of High Temperature Gas Cooled Reactors.” American Nuclear Society Annual Meeting. Online. 8 June 2020. (invited)
- R.N. Slaybaugh. Panelist for “Building Your Leadership Competency.” American Nuclear Society Annual Meeting. Online. 8 June 2020. (invited)
- R.N. Slaybaugh. “How Can Nuclear Be Part of a Clean Energy Future?” G20 Workshop on Circular Carbon Economy. Riyadh, KSA. 5 March 2020. (invited)
- R.N. Slaybaugh. “Special Update: ARPA-E Nuclear Program Update.” Advanced Reactors Summit VII. Knoxville, TN. 11 Feb 2020. (invited)
- R.N. Slaybaugh. “How Can Nuclear Energy Be Part of a Clean Energy Future?” Climate Tech Convening 2020. San Francisco, CA. 30 Jan 2020. (invited)
- R.N. Slaybaugh. Panelist for “Time to be Inclusive and Pragmatic Before Its Too Late: Advanced nuclear technologies must be a significant part of the solution set.” Cleantech Forum. San Francisco, CA. 28 Jan 2020. (invited)
- R.N. Slaybaugh. “What is ARPA-E Doing in Nuclear Energy?” Argonne National Laboratory Colloquium. Lemont, IL. 20 November 2019. (invited)
- R.N. Slaybaugh. Panelist for “The role of innovation in the civilian and military nuclear energy sectors.” The civilian-military nexus and the role of innovation in nuclear energy, Atlantic Council. Washington, DC. 15 Oct 2019. (invited)
- R.N. Slaybaugh. “Next Generation Nuclear.” Ecomodernism 2019. Middleburg, VA. 23 September 2019. (invited)
- R.N. Slaybaugh. “Nuclear and ARPA-E: Activities and Opportunities.” NUC Workshop: Innovations in Advanced Reactor Design, Analysis, and Licensing. Raleigh, NC (given remotely). 18 September 2019. (invited)
- R.N. Slaybaugh. “Nuclear Energy Programs and Research at Advanced Research Projects Agency-Energy (ARPA-E).” GABI nuclear energy roundtable. Washington, DC. 12 September 2019. (invited)
- R.N. Slaybaugh. Panelist for “Future Scientists and Engineers for Nuclear Energy.” Third Symposium on US-Japan Nuclear Energy Research Cooperation. Washington, DC. 26 June 2019. (invited)
- R.N. Slaybaugh. Panelist for “Lessons from Solar PV.” Breakthrough Dialogue 2019 Whole Earth Discipline. Sausalito, CA. 21 June 2019. (invited)
- R.N. Slaybaugh. “Computing in Nuclear Engineering: Moving Beyond Today’s Limitations.” MIT Nuclear Science & Engineering Colloquium. Cambridge, MA. 29 April 2019.

- R.N. Slaybaugh. "Creating the Future of Nuclear Energy." CITRIS Research Exchange Seminar Series. Berkeley, CA. 28 Nov. 2018. (invited)
- R.N. Slaybaugh. Panelist for "Ethics in Nuclear Engineering and Design." American Nuclear Society. Orlando, FL. 13 Nov. 2018. (invited)
- R.N. Slaybaugh. "U.S. Nuclear Innovation System." Commercialisation of Small Nuclear in the UK. Coventry, UK. 6 Nov. 2018. (invited)
- R.N. Slaybaugh. "MEITNER: The Newest ARPA-E Program." NASA iTech. New York, NY. 14 June 2018. (invited)
- R.N. Slaybaugh. "Deep decarbonization: financing the rapid deployment of innovations after R&D." 2050 Today Panel. San Francisco, CA. 15 June 2018. (invited)
- R.N. Slaybaugh. "Discussion of Future Technology Development." Nuclear R&D Summit Panel. Washington, DC. 7 Mar. 2018. (invited)
- R.N. Slaybaugh. "Advanced Solver for Radiation Transport." University of Illinois Urbana Champaign NPPE Dept. Graduate Colloquium. Champaign, IL. 5 Dec. 2017. (invited)
- R.N. Slaybaugh. "Commercialization of Nuclear Fusion Summit" Moderator, Nuclear Fusion: Reacting To Commercialization by VLAB. Palo Alto, CA. 14 Nov. 2017. (invited)
- R.N. Slaybaugh. "Nuclear Energy: What Can Analytics Do for Economics and Safety?" **Keynote Speaker**, Industrial Machine Learning Workshop 17. San Francisco, CA. 24 Oct. 2017. (invited)
- R.N. Slaybaugh. "Alternative energy, nuclear and CCS: What are the prospects?" Panelist, Low-Emissions Solution Conference at the 5th International Conference on Sustainable Development. New York, NY. 21 Sept. 2017. (invited)
- R.N. Slaybaugh. "The Case for Nuclear: Communications and Analyzing Risks and Benefits" Panelist, Aspen Institute Future of Nuclear Energy Roundtable. Aspen, CO. 12 Sept. 2017. (invited)
- R.N. Slaybaugh. "Advanced Solvers and Innovation for Penetrating Radiation" **Keynote Speaker**, SPIE Penetrating Radiation Technical Event. San Diego, CA. 8 Aug. 2017. (invited)
- R.N. Slaybaugh. "Challenges & Opportunities in Developing an Innovation Culture in Nuclear." Second Annual Third Way Advanced Nuclear Summit Panel. Washington, DC. 21 Feb. 2017. (invited)
- R.N. Slaybaugh. "Advancing Reactors with Advanced Solvers and Innovative Programs." Electric Power Research Institute. Research Meeting. Palo Alto, CA. 13 Feb. 2017. (invited)
- R.N. Slaybaugh. "Exploring the Advanced Nuclear Ecosystem." SxSW Eco Panel. Austin, TX. 12 Oct. 2016. (invited)
- R.N. Slaybaugh. "Nuclear Innovation: Concept to Execution." PHYSOR 2016. Sun Valley, ID. 2 May 2016. (invited)
- R.N. Slaybaugh. "The Opportunity of Global Nuclear Innovation." 49th Japan Atomic Industrial Forum (JAIF) Annual Conference. Tokyo, Japan. 12 April 2016. (invited)
- R.N. Slaybaugh. "Exascale Nuclear Innovation." **Keynote speaker**, Conference on Data Analysis 2016. Santa Fe, NM. 4 Mar. 2016. (invited)
- R.N. Slaybaugh. "Let's Get Real: When can we expect commercial advanced reactors?." The Advanced Nuclear Summit and Showcase Panel. Washington, DC. 27 Jan. 2016. (invited)
- R.N. Slaybaugh. "Hybrid Transport Methods for Shielding Challenges." Idaho National Laboratory seminar. Idaho Falls, ID. 20 Nov. 2015. (invited)

- K.L. Rowland, R.N. Slaybaugh. “Developments in the GPU-accelerated WARP Monte Carlo Neutron Transport Code.” Workshop sur l’utilisation des accélérateurs (GPUs, MICs) pour les simulations Monte-Carlo. École Polytechnique, Saclay, France. 10 July 2015.
- R.N. Slaybaugh. “Hybrid Methods for Shielding Challenges: Self-Shielding and Strong Anisotropies.” Colorado School of Mines NSE Program Graduate Colloquium. Golden, Colorado. 7 Jan. 2015. (invited)
- R.N. Slaybaugh. “PyNE and Nuclear Data: A Next Generation Tool.” Sather Next Generation Nuclear Science Meeting. Lawrence Berkeley National Laboratory. 9 Dec. 2014. (invited)
- R.N. Slaybaugh. “The PyNE Software Library: A Framework for ENSDF?” Nuclear Data Week Meeting. Brookhaven National Laboratory. 6 Nov. 2014.
- R.N. Slaybaugh. “The Resonance Factor Method: Accelerating Monte Carlo in the Presence of Space and Energy Self-Shielding.” CEA-Saclay Colloquium. Saclay, France. 26 June 2014.
- R.N. Slaybaugh, T.M. Evans, P.P.H. Wilson, S.C. Wilson. “Radiation Transport: Computational Methods and Real-World Use.” NC State Univ. NE Dept. Graduate Colloquium. Raleigh, NC. 8 Nov. 2012. (invited)
- R. Slaybaugh, M. Arbidze, S. Lamichhane, D. O’Connor. “An Evaluation of European Union Energy Policies.” UW–Madison Center for World Affairs and the Global Economy Seminar. Madison, WI. 11 May 2011.
- R.N. Slaybaugh, T.M. Evans, G.G. Davidson. “Parallel Algorithms for Fixed-Source and Eigenvalue Problems.” 2010 SIAM Annual Meeting. Pittsburgh, PA. 12-16 July 2010.

COMPUTER SKILLS

Languages	C++, Python, Fortran 90/95/2003
Versioning and Testing	git, svn, cvs, CTest, GoogleTest, nose, TravisCI
Tools	EC2, Doxygen, L ^A T _E X, MathCAD, Mathematica, shell, vim, bash, Emacs, Jupyter, Trilinos, LAPACK, MPI, Valgrind, cmake
Nuclear Software	Exnihilo, ADVANTG, MCNP, Serpent, SCALE, PyNE, MOOSE

AWARDED FUNDING

Current

- Anomaly Detection in Proprietary Data using Multi-Party Computation
PI: Rachel Slaybaugh (University of California, Berkeley)
Agency: Sandia National Laboratory
Amount awarded: \$332,600
Period of performance: Oct 1 2018 – Sept 30, 2021
- Training the Next Generation of Nuclear Engineers: Graduate Fellowships at the University of California, Berkeley
PI: Massimiliano Fratoni (University of California, Berkeley)
co-PI: Peter Hosemann, *Rachel Slaybaugh* (University of California, Berkeley)
Agency: Nuclear Regulatory Commission
Amount awarded: \$400,000
Period of performance: June 30, 2018 – June 29, 2022
- Methods for Process Monitoring to Accurately Detect and Quantify Material Holdup in Advanced Recycle Facilities
PI: Rachel Slaybaugh (University of California, Berkeley)

- co-PIs: Per Peterson, Kai Vetter, Karl van Bibber (University of California, Berkeley); Joseph Kowalczyk (Southern Company)
- Agency: Department of Energy, Office of Nuclear Energy
- Amount awarded: \$800,000
- Period of performance: Oct 1 2017 – Sept 30, 2020
- Department of Energy, Nuclear Science and Security Consortium (NSSC)
- Lead PI: Jasmina Vujic (University of California, Berkeley)
- co-PIs: Karl van Bibber, Kai Vetter, Barbara Jacak, Max Fraton, Lee Bernstein, *Rachel Slaybaugh*, Michael Nacht, Bethany Goldblum (University of California, Berkeley), Ken Czervinski (University of Nevada, Las Vegas), Michael Thoennessen (Michigan State University), Jason Hayward (University of Tennessee, Knoxville), Allison Macfarlane (George Washington University), Mani Tripathi (University of California, Davis), Mikael Nilsson (University of California, Irvine), Ralf Sudowe (University of Nevada, Las Vegas), Cody Folden (Texas A&M University)
- Agency: Department of Energy, National Nuclear Security Administration
- Amount awarded: \$25,000,000
- Period of performance: 2016 – 2021
- Training the Next Generation of Nuclear Engineers: Graduate Fellowships at the University of California, Berkeley
- PI: Peter Hosemann (University of California, Berkeley)
- co-PI: Massimiliano Fraton, *Rachel Slaybaugh* (University of California, Berkeley)
- Agency: Nuclear Regulatory Commission
- Amount awarded: \$400,000
- Period of performance: June 30, 2016 – June 29, 2020

Completed

- Nuclear Engineer Scholarships at the University of California, Berkeley to Support the Expansion and Diversity of the Undergraduate Program
- PI: Massimiliano Fraton (University of California, Berkeley)
- co-PI: Peter Hosemann, *Rachel Slaybaugh* (University of California, Berkeley)
- Agency: Nuclear Regulatory Commission
- Amount awarded: \$400,000
- Period of performance: June 30, 2016 – June 29, 2019
- Nuclear Engineering and Computational Methods
- PI: Rachel Slaybaugh (University of California, Berkeley)
- Agency: Lawrence Livermore National Laboratory
- Amount awarded: \$8,728
- Period of performance: Sept 8, 2016 – Sept 30, 2018
- Improved Hybrid Modeling of Used Fuel Storage Facilities
- PI: Rachel Slaybaugh (University of California, Berkeley)
- Collaborators: T. M. Evans, S. W. Mosher, and D. E. Peplow (Oak Ridge National Laboratory)
- Agency: Department of Energy, Office of Nuclear Energy
- Amount awarded: \$645,393
- Period of performance: Jan 1 2015 – Dec 31, 2017
- MOOSE Application Collaboration Specifically Pronghorn and RELAP-7
- PI: Rachel Slaybaugh (University of California, Berkeley)
- Agency: Idaho National Laboratory
- Amount awarded: \$12,000
- Period of performance: Feb 1 2016 – Jan 31, 2017
- University of California, Berkeley Department of Nuclear Engineering Graduate Fellowship Program

PI: Rachel Slaybaugh (University of California, Berkeley)
 co-PIs: Massimiliano Fratoni, Jasmina Vujic (University of California, Berkeley)
 Agency: Nuclear Regulatory Commission
 Amount awarded: \$400,000
 Period of performance: Aug 1 2014 – July 31, 2018

- Ex-core Dosimetry Calculations for a Pressurized Water Reactor and Comparison to Operational Data

PI: Rachel Slaybaugh (University of California, Berkeley)
 Agency: National Center for Computational Sciences (NCCS)
 Amount awarded: 5 million hours on Titan Supercomputer
 Period of performance: Feb 23 2017 – Aug 23, 2017

- Transport/Fluence Analysis Methods (purchase order)

PI: Rachel Slaybaugh (University of California, Berkeley)
 Agency: Westinghouse Electric Company
 Amount awarded: \$50,000
 Period of performance: Jan 1 2016 – Oct 28, 2016

- Department of Energy, Nuclear Science and Security Consortium (NSSC)

Lead PI: Jasmina Vujic (University of California, Berkeley)
 co-PIs: Micheal Nacht, Heino Nitsche, Rick Norman, *Rachel Slaybaugh*, and Kai Vetter (University of California, Berkeley), B. Sherrill (Michigan State University), M. Tripathi (University of California, Davis), G. Miller (University of California, Irvine), S. Shirk (UC/IGCC), K. Czerwinski (University of Nevada, Las Vegas), S. Lapi (Washington University of St. Louis)
 Agency: Department of Energy, National Nuclear Security Administration
 Amount awarded: \$26,500,000
 Period of performance: 2011 – 2016
 Role: Per Peterson was the original Nuclear Engineering co-PI; I replaced him when I started in 2014

HONORS AND AWARDS

American Nuclear Society (ANS) Young Member Excellence Award	2014
ANS Presidential Citation	2014
Rickover Fellowship	2008-2011
Second Place, 2011 ANS Winter Meeting Poster Session	2011
Selected participant, Modeling Experimentation and Validation Reactor Physics School	Jul. 2011
Selected participant, Energy Hub conference Poster Session	2011
Everitt P. Blizzard Memorial Scholarship, ANS	2010-2011
ANS Mathematics and Computation Division Best Summary + Presentation Award	Nov. 2010
Graduate Scholarship, ANS	2009-2010
Selected participant, Lindau Meeting of Nobel Laureates in Physics	2008
Second Place, 2007 ANS Winter Meeting Poster Session	Nov. 2007
Best Paper, Health Physics Track, 2007 ANS Student Conference	2007
Tau Beta Pi Honor Society	2006
Alpha Nu Sigma Honor Society	2005

PROFESSIONAL SERVICE

Good Energy Collective, Founding Board Chair, 2020-present

University of Michigan, NERS Department Advisory Board, 2019-present

Nuclear Innovation Alliance, Advisory Committee, 2018-present

Nuclear Energy Advisory Committee, Appointed Member, 2016-2017

Senior Fellow of the Breakthrough Institute, 2017-present

American Nuclear Society, National Level

Math and Comp. Division	Chair Rotation 2016-2019; Exec. Comm. 2013-2016
Rad. Protection and Shielding Div.	Exec. Comm. 2015-2018
Young Members Group	Exec. Comm. 2014-2017
NEED Comm.	Chair 2013-2015, Vice Chair 2010-2013
Professional Divisions Comm.	Vice Chair 2012-2016
Student Sections Comm.	Chair 2010-2013, Vice Chair 2009-2010
Professional Women in ANS	Chair 2008-2010, Vice Chair 2006-2008
Board of Directors	Student Member 2007-2009
Other committee service	Membership, Bylaws and Rules, Public Info., 2013 Nominating Comm., 2014 Special Selection Comm. for Nominating Comm. Candidates

Software and Computing

Berkeley Institute for Data Science (http://bids.berkeley.edu/)	Senior Fellow; Advisory Board Member
The Hacker Within, UCB and UW (http://thehackerwithin.github.io/berkeley/)	Faculty Advisor 2014-present; Co-founder 2009
Berkeley Research Computing (http://research-it.berkeley.edu/programs/berkeley-research-computing)	User Advisory Group 2016-present
Python for Nuclear Engineering (http://pyne.io/)	Contributor
Software and Data Carpentry (http://software-carpentry.org/)	Instructor since 2013
Berkeley Computing and Computer Science Education Committee	2014-present

Energy and Science

SIAM	Member 2009-present
Berkeley Energy and Resources Collaborative (BERC)	Advisory Board Member 2017-present
UCB-ANS	Faculty Advisor 2014-present
Nuclear Engineering Student Delegation	Co-Vice Chair 2010, Selected participant 2009
UW-Energy Hub	Conference Speaker Chair 2009, Founding Member 2007, liaison to Collegiate Energy Association 2008-2010

PUBLICATIONS

Italicized names indicate my students or researchers

A. J. Novak, R. W. Carlsen, S. Schunert, P. Balestra, R. N. Slaybaugh, and R. C. Martineau. “Pronghorn: A Multidimensional Coarse Mesh Application for Advanced Reactor Thermal-Hydraulics.” *Nuclear Technology*. (submitted 2020)

Richard Martineau, David Andrs, Robert Carlsen, Derek Gaston, Joshua Hansel Fande Kong, Alexander Lindsay, Cody Permann, Andrew Slaughter, Elia Merzari, Rui Hu, *April Novak*, Rachel Slaybaugh. “Multiphysics for Nuclear Energy Applications Using a Cohesive Computational Framework.” *Nuclear Engineering and Design*. (accepted 2020)

- A. J. Novak, J. W. Peterson, L. Zou, D. Andrš, R. N. Slaybaugh, R. C. Martineau, "Validation of Pronghorn Friction-Dominated Porous Media Thermal-Hydraulics Model with the SANA Experiments." *Nuclear Engineering and Design*. **350** (2019) 182-194.
<https://www.sciencedirect.com/science/article/pii/S0029549319301037>
- Nicholas J. Quartemont, James E. Bevins, Lee Bernstein, Rachel Slaybaugh. "Analysis of an Energy Tuning Assembly for Simulating Nuclear Weapon Environments at the National Ignition Facility." *Journal of Radiation Effects*. (Accepted 2020)
- Marissa Ramirez de Chanlette, Weixiong Zheng, R. N. Slaybaugh. "A Two-Grid and Nonlinear Diffusion Acceleration Method for the SN Equations with Neutron Upscattering." *Journal of Computational Transport Theory*. **49** 1 (2020) 1-14.
<https://doi.org/10.1080/23324309.2019.1695631>
- Mario Ortega, Rachel N Slaybaugh, Peter N Brown, Teresa S Bailey, Britton Chang. "A Rayleigh Quotient Method for Criticality Eigenvalue Problems in Neutron Transport." *Annals of Nuclear Energy*. **138** (2020) 107120.
<https://doi.org/10.1016/j.anucene.2019.107120>
- A. J. Novak, J. W. Peterson, L. Zou, D. Andrš, R. N. Slaybaugh, R. C. Martineau, "Validation of Pronghorn Friction-Dominated Porous Media Thermal-Hydraulics Model with the SANA Experiments." *Nuclear Engineering and Design*. **350** (2019) 182-194.
<https://www.sciencedirect.com/science/article/pii/S0029549319301037>
- Richard Vasques, Leonardo R. C Moraes, Ricardo C Barros, Rachel N Slaybaugh, "A Spectral Approach for Solving the Nonclassical Transport Equation." *Journal Of Computational Physics*. **402** (2020) 109078.
<http://arxiv.org/abs/1812.04811>
<https://www.sciencedirect.com/science/article/pii/S0021999119307831>
- Madicken Munk, Rachel Slaybaugh, "Review of Hybrid Methods for Deep-Penetration Neutron Transport." *Nuclear Science and Engineering*. **193** 10 (2019) 1055-1089.
<https://www.tandfonline.com/doi/full/10.1080/00295639.2019.1586273>
- J. S. Rehak, L. M. Kerby, M. D. DeHart, R. N. Slaybaugh. "Weighted Delta-Tracking with Scattering," *Nuclear Engineering and Design*. **342** (2019) 231-239.
<https://arxiv.org/abs/1802.02237>
- James Bevins, Zachary Sweger, Ninad Munshi, Bethany Goldblum, Josh Brown, Darren Bleuel, Lee Bernstein, Rachel Slaybaugh. "Performance Evaluation of an Energy Tuning Assembly for Neutron Spectral Shaping." *Nuclear Inst. and Methods in Physics Research, A*. **923** (2019) 79-87.
<https://www.sciencedirect.com/science/article/pii/S0168900219300968>
- Kelly L. Rowland, Cory D. Ahrens, Steven Hamilton, and R.N. Slaybaugh. "Assessment of the Lagrange Discrete Ordinates Equations for Three-Dimensional Neutron Transport" *Nuclear Science and Engineering*. **193** 3 (2019) 233-252.
<https://github.com/kellyrowland/ldo-deterministic>
- James E. Bevins, R.N. Slaybaugh. "Gnowee: A Metaheuristic Optimization Algorithm for Solving Engineering Problems Containing Continuous and Discrete Design Parameters." *Nuclear Technology*. **205** 4 (2019) 542-562.
<http://arxiv.org/abs/1804.05429>
- I. Makine, R. Vasques, R.N. Slaybaugh. "Exact Transport Representation of the Classical and Nonclassical Simplified P_N Equations." *Journal of Computational and Theoretical Transport*. **47** 4-6 (2018) 326-349.
<https://www.tandfonline.com/doi/abs/10.1080/23324309.2018.1496938>

- R.N. Slaybaugh, *M. Ramirez-Zweiger*, Tara Pandya, Steven Hamilton, T.M. Evans. “Eigenvalue Solvers for Modeling Nuclear Reactors on Leadership Class Machines,” *Nuclear Science and Engineering*. **190** (2017) 31-44.
<https://arxiv.org/abs/1708.04928>
- Jeffery B. Greenblatt, Nicholas R. Brown, Rachel Slaybaugh, Theresa Wilks, Emma Stewart, and Sean T. McCoy. “The Future of Low-Carbon Electricity,” *Annual Review of Environment and Resources*. **42** (2017) 289-316.
<http://www.annualreviews.org/doi/10.1146/annurev-environ-102016-061138>
- Ryan M. Bergmann, Kelly L. Rowland, Nikola Radnović, Rachel N. Slaybaugh, Jasmina L. Vujić. “Performance and Accuracy of Criticality Calculations Performed Using WARP, A Framework for Continuous Energy Monte Carlo Neutron Transport in General 3D Geometries on GPUs,” *Annals of Nuclear Energy*. **103** (2017) 334-349.
<https://www.sciencedirect.com/science/article/pii/S0306454916309902>
- Leah E. Morgan, *Madicken Munk*, Brett Davidheiser-Kroll, Nicholas H. Warner, Sanjeev Gupta, Rachel Slaybaugh, Patrick Harkness, Darren F. Mark. “Instrumentation development for planetary in situ $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology,” *Geostandards and Geoanalytical Research*. **41**:3 (2017) 381-396.
<https://onlinelibrary.wiley.com/doi/full/10.1111/ggr.12170>
- R. Vasques, K. Krycki, R. N. Slaybaugh. “Nonclassical Particle Transport in One-Dimensional Random Periodic Media,” *Nuclear Science and Engineering*. **185**:1 (2017) 78-106.
<https://arxiv.org/abs/1602.00825>
- S.C. Wilson and R.N. Slaybaugh. “Improved Monte Carlo Variance Reduction for Space and Energy Self-Shielding,” *Nuclear Science and Engineering*. **179**:1 (2015) 22-41.
<https://arxiv.org/abs/1502.04749>
- G.G. Davidson, T.M. Evans, J.J. Jarrell, S.P. Hamilton, T.M. Pandya, and R.N. Slaybaugh, “Massively Parallel, Three-Dimensional Transport Solutions for the k-Eigenvalue Problem,” *Nuclear Science and Engineering*. **177**:2 (2014) 111-125.
<https://www.tandfonline.com/doi/abs/10.13182/NSE12-101>
- R.N. Slaybaugh, T.M. Evans, G.G. Davidson, and P.P.H. Wilson. “Multigrid in energy preconditioner for Krylov solvers,” *Journal of Computational Physics*. **242** (2013) 405-419.
<https://arxiv.org/abs/1612.00907>
- T.M. Evans, A.S. Stafford, R.N. Slaybaugh, and K.T. Clarno. “Denovo—A new three-dimensional parallel discrete ordinates code in SCALE.” *Nuc. Tech.* **171**:2 (2010) 171-200.
<https://www.tandfonline.com/doi/abs/10.13182/NT171-171>
- R.N. Slaybaugh, P.P.H. Wilson, L.A. El-Guebaly, and E.P. Marriott. “Three-Dimensional Neutron Source Models for Toroidal Fusion Energy Systems.” *Fusion Engineering and Design*. **84** (2009) 1774-1778.
<https://www.sciencedirect.com/science/article/pii/S0920379609000076>

Refereed Conference Proceedings

- Grey Batie, *Vanessa Goss*, Laura Shi, Christopher Poresky, Lucian Mihalescu, Per Peterson, Rachel Slaybaugh, and Kai Vetter. “Fault Detection Methods To Accurately Detect And Quantify Holdup In Advanced Nuclear Material Recycle Facilities.” Proceedings of Institute of Nuclear Materials Management 61st Annual Meeting in Baltimore, MD, July 2020.
- Mitch Negus*, Rachel Slaybaugh, and David Farley. “Garbled circuits for enabling privacy preserving safeguards.” Proceedings of Institute of Nuclear Materials Management 61st Annual Meeting in Baltimore, MD, July 2020.

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- M. I. Ortega*, P. N. Brown, T. S. Bailey, and B. Chang, and R. N. Slaybaugh. “A Rayleigh Quotient Method for Criticality Eigenvalue Problems in Neutron Transport.” Proceedings of PHYTRA4 - The Fourth International Conference on Physics and Technology of Reactors and Applications in Marrakech, Morocco, Sept 17-19, 2018. [invited]
- Sandra Bogetic, *James E. Bevins*, Lee A. Bernstein, Rachel Slaybaugh, and Jasmina Vujić. “Meta-heuristic Optimization Method for Neutron Spectra Shaping.” Proceedings of the 2018 ANS June Meeting in Philadelphia, PA, June 2018. Transactions vol. 118.
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- A. Novak*, P. Romano, B. Wendt, R. Rahaman, E. Merzari, L. Kerby, C. Permann, R. Martineau, and R. N. Slaybaugh. “Preliminary Coupling of OpenMC and Nek5000 Within The MOOSE Framework.”

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- I. Makine, R. Vasques*, and R.N. Slaybaugh. “Exact Transport Representations of the Classical and Nonclassical Simplified P_N Equations.” 25th International Conference on Transport Theory, Monterey, CA, 16-20 Oct 2017.
- M. I. Ortega*, P.N. Brown, T. S. Bailey, R. N. Slaybaugh, and B. Chang. “A Rayleigh Quotient Method for Solving the Alpha-Eigenvalue Problem in Neutron Transport.” 25th International Conference on Transport Theory, Monterey, CA, 16-20 Oct 2017.
- Marissa Ramirez Zweiger, Weixiong Zheng*, and R.N. Slaybaugh. “Two-Grid and Nonlinear Diffusion Acceleration Method for the Multigroup S_N Equations with Neutron Upscattering.” 25th International Conference on Transport Theory, Monterey, CA, 16-20 Oct 2017.
- M. Wrenninge, *R. Vasques*, R.N. Slaybaugh. “A Generalized Volume Rendering Approach for Computer Graphics.” 25th International Conference on Transport Theory, Monterey, CA, 16-20 Oct 2017.
- J.S. Rehak*, L.M. Kerby, M.D. DeHart, R.N. Slaybaugh, J. Leppänen. “Implementation of Weighted Delta-Tracking with Scattering in the Serpent 2 Monte Carlo Code.” Proceedings of the 2017 ANS June Meeting in San Francisco, CA, June 2017. Transactions vol. 116.
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- Kelly L. Rowland, Ryan M. Bergmann*, Rachel N. Slaybaugh, Jasmina L. Vujić. “Delta-tracking in the GPU-accelerated WARP Monte Carlo Neutron Transport Code.” International Conference on Mathematics & Computational Methods Applied to Nuclear Science & Engineering, Jeju, South Korea, Apr 2017. [invited]
- R. Vasques* and R. N. Slaybaugh. “Simplified P_N Equations For Nonclassical Transport With Isotropic Scattering.” International Conference on Mathematics & Computational Methods Applied to Nuclear Science & Engineering, Jeju, South Korea, Apr 2017. [invited]
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- Richard Vasques*, Rachel Slaybaugh, Kai Krycki, “Nonclassical Particle Transport in the 1-D Diffusive Limit.” Proceedings of the 2016 ANS June Meeting in New Orleans, LA, June 2016. Transactions vol. 114.
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- J. Bevins*, R. Slaybaugh, L. Bernstein, W. Dunlop, E. Henry. “Application of Metaheuristic Optimization Methods for Neutron Spectral Shaping Applications.” Proceedings of the Conference on Data Analysis 2016 in Santa Fe, NM, Mar 2016.
- K. L. Rowland*, R. N. Slaybaugh, *R. M. Bergmann*, and J. Vujić, “Implementing delta-tracking in a GPU-accelerated Monte Carlo neutron transport,” Proceedings of Frontiers in Computational Physics: Energy Sciences in Zurich, Switzerland, June 2015.
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- S.C. Wilson and R.N. Slaybaugh. "Monte Carlo Importances in the Presence of Space and Energy Self-Shielding," Proceedings of the 2013 ANS Winter Meeting in Washington, DC, Nov 2013. Transactions vol. 109.
- R.N. Slaybaugh and S.C. Wilson. "Deterministic Parameter Study for Fixed-Source Calculations Using FW-CADIS," Proceedings of the 2013 ANS Annual Meeting in Atlanta, GA, June 2013. Transactions vol. 108.
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- P.J. Snouffer, R.N. Slaybaugh, and P.P.H. Wilson. "Criticality Benchmark Comparisons for DAGMC," Proceedings of the 2011 ANS Annual Meeting in Hollywood, FL, June 2011. Transactions vol. 104.
- G.G. Davidson, T.M. Evans, J.J. Jarrell, and R.N. Slaybaugh, "Massively Parallel, Three-Dimensional Transport Solutions for the k-Eigenvalue Problem," Proceedings of the International Conferences on Mathematics and Computational Methods Applied to Nuclear Science and Engineering in Rio de Janeiro, RJ, Brazil, May 2011.
- G.G. Davidson, T.M. Evans, R.N. Slaybaugh, and C.G. Baker. "Massively Parallel Solutions to the k-Eigenvalue Problem," Proceedings of the 2010 ANS Winter Meeting in Las Vegas, NV, Nov 2010. Transactions vol. 103. [winner of Mathematics and Computation Division "Best Summary + Presentation" award]
- T.M. Evans, G.G. Davidson, and R.N. Slaybaugh. "Three-Dimensional Full Core Power Calculations for Pressurized Water Reactors," Proceedings of the 2010 Scientific Discovery through Advanced Computing (SciDAC) Conference. Chattanooga, TN, 11-15 July, 2010. Oak Ridge National Laboratory.
- R.N. Slaybaugh, "Scouting Programs for Educational Outreach," Proceedings of the 2009 ANS Winter Meeting in Washington, DC, Nov 2009. Transactions vol. 101.
- R.N. Slaybaugh, E.P. Marriott, P.P.H. Wilson, and L. El-Guebal, "A Study of the Effects of Source Sampling Methods on ARIES-RS NWL Profiles," Proceedings of the ARIES-Pathways Project Meeting, 28-29 May 2008, Madison WI.
- R.N. Slaybaugh, M.L. Williams, D. Ilas, D.E. Peplow, B.L. Kirk, T.L. Nichols, Y.Y. Azmy, and M.P. Langer, "Radiation Treatment Planning Using Discrete Ordinates Codes," Proceedings of the 2007 ANS Annual Meeting in Boston, MA, June 2007. Transactions vol. 96.
- R. Slaybaugh. "Strengths and Weaknesses of Nuclear Engineering Education," presented at 2007 ANS Annual Meeting in Boston, MA, June 2007. Transactions vol. 96.

Technical Reports

- David R. Farley, *Mitch G. Negus*, Rachel N. Slaybaugh. “Industrial Internet-of-Things & Data Analytics for Nuclear Power & Safeguards.” Sandia National Laboratories, SAND2018-12807, November 2018.
- A.J. Novak, L. Zou, J.W. Peterson, D. Andrs, J. Kelly, R.N. Slaybaugh, R.C. Martineau, and H.D. Gougar. Pronghorn Theory Manual. Idaho National Laboratory, INL/EXT-18-44453, January 2018.
- L. Bernstein, D. Brown, et al. “Nuclear Data Needs and Capabilities for Applications.” White Paper. Lawrence Berkeley National Laboratory, May 27-29 2015.
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Book Chapters

- Slaybaugh, Rachel. “Reproducible Computational Science on High Performance Computers.” *The Practice of Reproducible Research, Case Studies and Lessons from the Data-Intensive Sciences*, edited by Justin Kitzes, Daniel Turek, and Fatma Deniz, UC Press, 2017.
<https://www.practicereproducibleresearch.org/case-studies/slaybaugh.html>

Other Works : Software

- Josh Rehak, Weixiong Zheng, Alexander Blank, Ramirez de Chanlette, R. N. Slaybaugh. BART. Software (released 2019)
<https://github.com/SlaybaughLab/BART>
- James Bevins, Youdong Zhang, and Rachel Slaybaugh. “Coeus.” Software. (released 2017) <https://github.com/SlaybaughLab/Coeus>
- James Bevins, Youdong Zhang, and Rachel Slaybaugh. “Gnowee.” Software. (released 2017) <https://github.com/SlaybaughLab/Gnowee>
- Ryan M. Bergmann, Kelly L. Rowland, Nikola Radnović, Rachel N. Slaybaugh, Jasmina L. Vujić. “WARP.” Software (released 2017) <https://github.com/SlaybaughLab/warp>
- PyNE: The Nuclear Engineering Toolkit. Software. (periodic contributions 2014-2017)
<https://github.com/pyne/pyne>

Other Works : Funding Opportunity Announcements

- Rachel Slaybaugh, Joel Fetter, Curt Nehrkorn, Geoffrey Short. “Generating Electricity Managed by Intelligent Nuclear Assets (GEMINA).” Funding Opportunity No. DE-FOA-002174. (released Oct 2, 2019)
<https://arpa-e-foa.energy.gov/#FoaId4f8d5ac3-267d-4849-ad63-80f858761a74>
- Rachel Slaybaugh, Joel Fetter, Geoffrey Short. “Request for Information (RFI) on Intelligent Analytics, Algorithms, and Maintenance to Optimize Operations in Advanced Nuclear Reactors.” Request for Information (RFI) DE-FOA-0002115. (released March 26, 2019)
<https://arpa-e-foa.energy.gov/#FoaIdad3db639-ff92-447b-8b59-cde43defa55a>
- Rachel Slaybaugh. “Leveraging Innovations Supporting nuclear Energy.” Funding Opportunity No. DE-FOA-0001953, Initial Announcement. (released Dec 20, 2018)
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- Rachel Slaybaugh, JC Zhao. “Modeling Enhance Innovations Trailblazing Nuclear Energy Reinvigoration (MEITNER).” Funding Opportunity No. DE-FOA-0001798. (released Oct 20, 2017)
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MENTORING

Doctoral Advisement

- Chair, Dissertation Committee: April Novak (NE), “Multiscale Thermal-Hydraulic Methods for Pebble Bed Reactors.” UC Berkeley 2020.
- Chair, Dissertation Committee: Mario Ortega (NE), “A Rayleigh Quotient Fixed Point Method for Criticality Eigenvalue Problems in Neutron Transport.” UC Berkeley 2019.
- Chair, Dissertation Committee: Kelly Rowland (NE), “Advanced Quadrature Selection for Monte Carlo Variance Reduction.” UC Berkeley 2018.
- Chair, Dissertation Committee: James Bevins (NE), “Targeted Modification of Neutron Energy Spectra for National Security Applications.” UC Berkeley 2017.
- Chair, Dissertation Committee: Madicken Munk (NE), “FW/CADIS- Ω : An Angle-Informed Hybrid Method for Neutron Transport.” UC Berkeley 2017.
- Chair, Dissertation Committee: Nathan Bailey (NE), “Atom probe tomographic analysis of high dose oxide-dispersion strengthened steel (alloy MA957) at selected irradiation conditions.” UC Berkeley 2016.
- co-Chair, Dissertation Committee: Sebastian Schunert (NE), “Comparing various Spatial Discretization Schemes based on a Method of Manufactured Solution Benchmark Suite.” North Carolina State University 2013.
- Member, Dissertation Committee: Daniel Wooten (NE), “Predicting Fuel Salt Composition via Linear Optimization in Molten Salt Reactors.” UC Berkeley 2019.
- Member, Dissertation Committee: Stephen Parker (NE), “Synthesis, Characterization, and Neutronic Modeling of (ThxU $_{1-x}$)N Fuels for Application in Compact Nuclear Reactors.” UC Berkeley 2018.
- Member, Dissertation Committee: Nicholas Thompson (Nuclear Engineering and Science), “Measuring and Validating Neutron Capture Cross Sections Using a Lead Slowing-Down Spectrometer.” Rensselaer Polytechnic Institute 2017.
- Member, Dissertation Committee: Ryan Bergmann (NE), “The Development of WARP - A Framework for Continuous Energy Monte Carlo Neutron Transport in General 3D Geometries on GPUs.” UC Berkeley 2014.

Master’s Advisement

- Chair, Thesis Committee: Marissa Ramirez Zweiger (NE), “A Two-Grid, Nonlinear Diffusion Acceleration Method for the SN Equations with Neutron Upscattering.” UC Berkeley 2018.
- Chair, Thesis Committee: Mitch Negus (NE), “Ex-Core fluence analysis of an operating reactor using VERAShift.” UC Berkeley 2018.
- Chair, Thesis Committee: Joshua Rehak (NE), “Weighted Delta-Tracking with Scattering implemented in the Serpent 2 Monte Carlo Code.” UC Berkeley 2017.
- Chair, Thesis Committee: Kelly Rowland (NE), “Delta-tracking in the GPU-accelerated WARP Monte Carlo Neutron Transport Code.” UC Berkeley 2015.
- Member, Thesis Committee: Daniel Wooten (NE), “Future needs of circulating fuel reactor kinetics modeling.” UC Berkeley 2017.
- Member, Thesis Committee: Ilker Makine (NE), “Exact Transport Representations of the Classical and Nonclassical Simplified PN Equations with Isotropic Scattering.” Institut National des Sciences et Techniques 2017.

- Member, Thesis Committee: Milos Atz (NE), “Effect of initial enrichment and discharge burnup on the minimum critical mass of far-field depositions of fissile material from LWR spent fuel.” UC Berkeley 2016.
- Member, Thesis Committee: Dan Shen (NE), “Preliminary feasibility assessment of molten salt cooled reactor with pin-type fuel.” UC Berkeley 2016.

Directed Undergraduate Independent Study at UC Berkeley

- Spring and Summer 2018: Alexander Blank
- Fall 2017: Emily Vu and Jaqueline Garcia
- Fall 2016 and Spring 2017: Eliav Maas

Directed Undergraduate Research at UC Berkeley

Laura Shi: Jan 2019 – present; Emily Vu: April 2016 – May 2019; Jemin Desai: Sept 2016 – Sept 2017; David Smith: June 2016 – Aug 2017; Mingjian Lu: June 2016 – Aug 2017; Will Kable: Aug 2016 – May 2017; Youdoung Zhang: Aug 2016 – May 2017; Garrett Baltz: Feb 2015 – July 2016; Josh Howland: Jan 2014 – May 2016; Clay Sheih: Dec 2015 – May 2016; Soham Shah: May 2015 – Aug 2015; Joseph Labrum: May 2015 – Aug 2015; Marissa Ramirez-Zweiger: Nov 2014 – Aug 2015; Nikola Radnovic Jan 2014 – May 2014

Other Scholars

- Mentored Weixiong Zheng as a Postdoctoral Scholar March 2017–Dec 2018; Dr. Zheng is now employed at a Bay Area software startup
- Mentored Richard Vasques as an Assistant Project Scientist June 2015– June 2017; Dr. Zheng is now a professor at The Ohio State University
- Mentored Ilker Makine as a Visiting Scholar Summer 2017