RACHEL N. SLAYBAUGH

slaybaugh@berkeley.edu ◇ (570) · 850 · 3385
Department of Nuclear Engineering ◇ University of California, Berkeley
4173 Etcheverry Hall MC 1730 ◇ Berkeley, CA 94720

EDUCATION

Ph.D.	**University of Wisconsin–Madison**		2011
	Nuclear Engineering and Engineering Physics, with a certificate in Energy Analysis and Policy	GPA: 3.971	
M.S.	**University of Wisconsin–Madison**		2008
	Nuclear Engineering and Engineering Physics	GPA: 3.958	
B.S.	**Pennsylvania State University**		2006
	Nuclear Engineering	GPA: 3.67	

RESEARCH EXPERIENCE

University of California, Berkeley Jan. 2014 - Present
Assistant Professor of Nuclear Engineering *Berkeley, CA*

- Research based in numerical methods for neutral particle transport with an emphasis on supercomputing
- Applications in reactor design, shielding, and nuclear security and nonproliferation

Bettis Laboratory Mar. 2012 - Aug. 2014
Senior Engineer in the Shield Design and Development group *West Mifflin, PA*

- 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 Sept. 2006 - Nov. 2011
Research Assistant / Rickover Fellow *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
- Investigated effects of uncertainty in gamma sources on Monte Carlo transport
- Developed two Monte Carlo source sampling methods for arbitrarily shaped plasma sources; the sources are generated directly from plasma physics data
- Wrote an efficient sampling method for secondary photon sources in the Monte Carlo CAD software library, Direct Accelerated Geometry Monte Carlo (DAGMC)

Knolls Atomic Power Laboratory Summer 2009
Rickover Fellow Practicum *Schenectady, NY*

- Helped couple the Monte Carlo code MC21 to the deterministic code Jaguar via the interface code UNIK for the purpose of variance reduction

- Added weight window capability to MC21
- Investigated and recommended methods for creating weight window values

Forschungszentrum Karlsruhe (KIT) May 2008 - Dec. 2008
Visiting Researcher *Karlsruhe, Germany*

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

Oak Ridge National Laboratory Summers 2005 & 2006
Summer Intern *Oak Ridge, TN*

- Investigated use of the 3-D deterministic transport code TORT for radiation treatment planning (RTP) when using proper cross sections
- Demonstrated that RTP is possible with TORT, but for limited cases
- Learned about electron transport and created electron cross sections with CEPXS

Penn State Breazeale Reactor Aug. 2003 - Apr. 2006
Reactor Operator *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 Jan. 2014 - Present
Assistant Professor of Nuclear Engineering *Berkeley, CA*

- Taught NE 155, Introduction to Numerical Simulations for Radiation Transport, Spring 2014 and 2015 (senior-level elective)
- Taught NE 24, Putting the Science in Computational Science, Spring 2015 (Freshman seminar)

Software Carpentry Scientific Computing Workshops
Instructor *Berkeley, CA*

- Jan. 5-6, 2015: version control; hosted by University of Colorado, Boulder
- Apr. 14-15, 2014: introductory material, version control, object oriented concepts in Python; hosted by Lawrence Berkeley National Laboratory

Bettis Laboratory Mar. 2012 - Aug. 2014
Senior Engineer in the Shield Design and Development group *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
- Used internally-written shielding text by R. Amato

University of Pittsburgh Fall 2012, Spring 2013
Adjunct Professor *Pittsburgh, PA*

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

Virtual Science Challenge Apr. 2012-Mar. 2013
Mentor *Monterey, CA*

- Mentor for winning U.S. team in international nuclear nonproliferation science fair, organized through the Center for Nonproliferation Studies
- Facilitated online discussions, participated in workshops, and served as an information resource for the students throughout their project

Penn State Breazeale Reactor Jan. 2003 - Apr. 2006
Educational Outreach *University Park, PA*

- Taught Freshman Seminar and led tours for kindergarten through college students
- Developed educational tools such as handouts, presentations, and games

SELECTED PRESENTATIONS

R.N. Slaybaugh. "Hybrid Methods for Shielding Challenges: Self-Shielding and Strong Anisotropies." Colorado School of Mines NE 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. "Advanced Approaches to High-Performance Computing in Nuclear: Applications to Non-Proliferation." MIIT Delegation Visit to BNRC. Berkeley, CA. 8 Dec. 2014.

R.N. Slaybaugh. "Computational Methods and Software Development in Nuclear Engineering Research." Tea at Berkeley Institute for Data Science. Berkeley, CA. 4 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.N. Slaybaugh. "Acceleration Methods for Massively Parallel Deterministic Transport." KAPL Employment Meeting. Niskayuna, NY. 30 Aug. 2011. (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. "Krylov Methods and JFNK." UW–Madison Radiation Hydrodynamics Meeting. Madison, WI. 16 Dec. 2010. (invited)

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.

R.N. Slaybaugh. "Variance Reduction in MC21 using Forward Adjoint Variance Reduction (FAVRE)." Naval Reactors Shielding Video-conference. Pittsburgh, PA. Aug. 2010.

R.N. Slaybaugh. "MC21 Jaguar Coupling for Variance Reduction." KAPL Physics Forum. Niskayuna, NY. July 2009.

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. Blizard 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
Best Paper, Outreach and Education Track, 2005 ANS Student Conference	2005

COMPUTER SKILLS

Languages	C++, Python, Fortran 90/95/2003
Version Control	git, svn, cvs
Test Frameworks	CTest, GoogleTest, nose
Tools	Doxygen, LaTeX, MathCAD, Mathematica, MCNP, the shell, Vim, tcsh, bash, Emacs, Trilinos, LAPACK, MPI, Valgrind

PROFESSIONAL SERVICE

American Nuclear Society, National Level

Math and Comp. Division	Exec. Comm. 2013-present
Young Members Group	Exec. Comm. 2014-present
NEED Comm.	Chair 2013-present, Vice Chair 2010-2013
Professional Divisions Comm.	Vice chair 2012-present
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

The Hacker Within, UCB (http://thehackerwithin.github.io/berkeley/)	Faculty Advisor 2014-present
Software Carpentry (http://software-carpentry.org/)	Instructor since 2013
Python for Nuclear Engineering (http://pyne.io/)	Contributor
The Hacker Within, UW	Bootcamp instructor 2009, Founding member 2009

Energy and Science

SIAM	Member 2009-present
UCB–ANS	Faculty co-Advisor 2014-present
Nuclear Innovation Research	Member 2014-present

Consortium (NIRC)	
UW–SIAM	Founding member 2009
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
UW–Women In Nuclear	President 2008-2009, Vice President 2006-2008, Founding Member 2006
UW–ANS	Public Information Officer 2006-2007
Fireside Society	Judging advisor for Clean Tech Open competition 2011, Member 2011-present

PUBLICATIONS

S.C. Wilson and R.N. Slaybaugh. "Improved Monte Carlo Variance Reduction for Space and Energy Self-Shielding," *Nuclear Science and Engineering.* **179** (2015) 22-41.

Elliott Biondo, Anthony Scopatz, Matthew Gidden, Rachel Slaybaugh, and Cameron Bates. "Quality Assurance within the PyNE Open Source Toolkit," Proceedings of the 2014 ANS Winter Meeting in Anaheim, CA, November 2014. Transactions vol. 111.

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, 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.

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.

R.N. Slaybaugh, T.M. Evans, G.G. Davidson, and P.P.H. Wilson. "Rayleigh Quotient Iteration in 3D, Deterministic Neutron Transport," Proceedings of the PHYSOR 2012 Meeting in Knoxville, TN, April 2012.

G.G. Davidson, T.M. Evans, J.J. Jarrell, R.N. Slaybaugh, and C.G. Baker, "Massively Parallel, Three-Dimensional Transport Solutions for the k-Eigenvalue Problem," *Nuclear Science and Engineering.* **177** (2014) 111-125.

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.

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** (2010) 171-200.

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, 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.

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.