# Selected Publications

**Rachel N. Slaybaugh**

March 17, 2019

Italicized names indicate my students or researchers

*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.* (Submitted 2019)

*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.* (Submitted 2019)

*A. J. Novak*, J. W. Peterson, L. Zou, D. Andrš, R. N. Slaybaugh, R. C. Martineau, "Validation of Pronghorn Low-Advection Porous Media Thermal-Hydraulics Model with the SANA Experiments." *Nuclear Engineering and Design.* (Submitted 2019)

*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.* (Submitted 2018)
`http://arxiv.org/abs/1812.04811`

*Madicken Munk*, Rachel Slaybaugh, "Review of Hybrid Methods for Deep-Penetration Neutron Transport." *Nuclear Science and Engineering.* (Accepted 2019)

*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." *Inst. and Methods in Physics Research, A.* (Accepted 2019)

*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://doi.org/10.1016/j.nucengdes.2018.12.006`
`https://arxiv.org/abs/1802.02237`

*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.* (Accepted 2018)
`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.* (Accepted 2018)
`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.* (Accepted 2018).

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**

(Nov 2017).
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.

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 $^{40}Ar/^{39}Ar$ geochronology," *Geostandards and Geoanalytical Research.* **41** 3 (2017) 381-396.

*R. Vasques*, K. Krycki, R. N. Slaybaugh. "Nonclassical Particle Transport in 1-D Random Periodic Media," *Nuclear Science and Engineering.* **185** (2017) 16-35.
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** (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** (2014) 111-125.

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** (2010) 171-200.

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.

**Refereed Conference Proceedings**

*April J. Novak*, Ling Zou, John W. Peterson, Richard C. Martineau, and Rachel N. Slaybaugh, "Pronghorn: Porous Media Thermal-Hydraulics for Reactor Applications." Proceedings of the 2018 ANS Winter Meeting in Orlando, FL, Nov. 2018. Transactions vol. 119. [invited]

*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, September 17-19, 2018. [invited]

*James E. Bevins*, Sandra Bogetic, Lee A. Bernstein, Rachel Slaybaugh, and Jasmina Vujić, "Metaheuristic Optimization Method for Neutron Spectra Shaping." Proceedings of the 2018 ANS June Meeting in Philadelphia, PA, June 2018. Transactions vol. 118.

*A.J. Novak*, L. Zou, J.W. Peterson, R.C. Martineau, and R.N. Slaybaugh, "Pronghorn: A Porous Media Thermal-Hydraulics Core Simulator and its Validation with the SANA Experiments." Proceedings of the International Congress on Advances in Nuclear Power Plants in Charlotte, NC, April 2018.

*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." Proceedings of the PHYSOR 2018 Meeting in Cancun, Mexico, April 2018.

*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 October 2017.

*M. I. Ortega*, P.N. Brown, T. S. Bailey, R. N. Slaybaugh, and B. Chang. "A Raiyleigh Quotient Method for Solving the Alpha-Eignevalue Problem in Neutron Transport." 25th International Conference on Transport Theory, Monterey, CA, 16-20 October 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 October 2017.

*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 October 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 Fansicso, CA, June 2017. Transactions vol. 116.

*Weixiong Zheng*, Ryan McClarren, Rachel Slaybaugh. "A Continuous-Discontinuous Hybrid Finite Element Method for Solving Radiation Transport." Proceedings of the 2017 ANS June Meeting in San Fansicso, CA, June 2017. Transactions vol. 116.

*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, April 2017. [invited]
`https://arxiv.org/abs/1610.04314`

*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, April 2017. [invited]

*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.
`https://arxiv.org/abs/1601.02495`

*M. Munk*, R.N. Slaybaugh, Tara M. Pandya, Seth R. Johnson, T. M. Evans, "FW/CADIS-Ω: An Angle-Informed Hybrid Method for Deep-Penetration Radiation Transport." Proceedings of the PHYSOR 2016 Meeting in Sun Valley, ID, May 2016.
`https://arxiv.org/abs/1612.00793`

*J. Bevins*, R. Slaybaugh, L. Bernstein, E. Henry, W. Dunlop, "Targeted Modification of Neutron Energy Spectra for National Security Applications." Proceedings of the 2016 Hardened Electronics And Radiation Technology Technical Interchange Meeting in Monterey, CA, April 2016.

*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, March 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.

R.N. Slaybaugh, T.M. Evans, G.G. Davidson, and P.P.H. Wilson, "Rayleigh Quotient Iteration with a Multigrid in Energy Preconditioner for Massively Parallel Neutron Transport," Proceedings of Joint International Conference on Mathematics and Computation, Supercomputing in Nuclear Applications, and the Monte Carlo Method in Nashville, TN, April 2015.
`https://arxiv.org/abs/1702.02111`

*M. Munk*, L. Morgan, R. Slaybaugh, B. Davidheiser-Kroll, K. van Bibber, and D. Mark, "Design and Feasibility Study of a Compact Neutron Source for Extraterrestrial Geochronology Applications," Proceedings of Joint International Conference on Mathematics and Computation, Supercomputing in Nuclear Applications, and the Monte Carlo Method in Nashville, TN, April 2015.

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.

Cameron Bates, Elliott Biondo, Kathryn Huff, and et al. "PyNE Progress Report," 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 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.

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. `https://arxiv.org/abs/1511.07772`

**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**

"Modeling Enhance Innovations Trailblazing Nuclear Energy Reinvigoration (MEITNER)." Funding Opportunity No. DE-FOA-0001798, CFDA Number 81.135 (released Oct 20, 2017) `https://arpa-e-foa.energy.gov/Default.aspx?Archive=1#FoaId9688fafc-3b63-42af-9786-77d930987b4a`

*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`