# Derek Gaston

2942 Glenn Cove Ct. • Ammon, ID 83406
208-709-4684
derek.gaston@gmail.com

**Education:**
*Master of Science*, Computational and Applied Mathematics, 2006
University of Texas, Austin, TX
- GPA: 3.63
- Thesis: "Automatic Mesh Redistribution Using General Error Indicators in an Integrated Framework"
- Advisor: Dr. Graham Carey

*Bachelor of Science*, Computer Science, 2004
University of Missouri, Rolla, MO
- GPA: 4.0
- Enrolled as a student in the Minority Engineering Program.

**Honors:**
- 2011 Presidential Early Career Award for Scientists and Engineers (PECASE), awarded by President Obama
- 2011 Idaho National Laboratory Director Group Award to MOOSE Team
- 2010 Idaho National Laboratory Director Award for Early Career Exceptional Achievement

**Professional Experience:**

May 2008 - Present
**Idaho National Laboratory**, Idaho Falls, ID
Fuels Modeling and Simulation
Group Lead for Computational Frameworks
- Leading the international development effort to create the Multiphysics Object-Oriented Simulation Environment (MOOSE) framework.

January 2005 - May 2008
**Sandia National Laboratories**, Albuquerque, NM
Advanced Computational Mechanics Architectures
Software Engineer
- Developed an object oriented C++ application to support large scale, parallel, verification and validation of computational sciences codes.
- Enhanced an existing computational sciences framework library through implementation of a completely modular system for adaptivity and error estimation.
- Built and maintained a suite of tools for compiling and developing engineering applications.

September 2002 - December 2004
**Mark IV Automotive**, Springfield, MO
Advanced Research and Engineering
Software Engineer / Research Assistant
- Created a deployable C++ application for predicting Poly-V-Rib belt tracking.

June 2002 - September 2002
**Paul Mueller Corporation**, Springfield, MO
Software Engineer
- Retooled existing heat exchanger pricing system using a combination of Javascript, C++, Fortran and ASP.

June 2001 - December 2001
**Central Intelligence Agency**, Langley, VA
Software Engineer
- Utilized PHP and MySQL to create a record keeping system.
- Combined JSP and Oracle producing a database browsing application.

# Funded Research

# Journal Articles

M. P. Short, D. Gaston, C. Stanek, and S. Yip. A perspective on nuclear materials: The quest for scientific advances with technological impact. Materials Research Society Bulletin (MRS-B), (Accepted) 2013.

L. Zhang, M. R. Tonks, D. Gaston, J. W. Peterson, D. Andrs, P. C. Millett, and B. S. Biner. A quantitative comparison between $c^0$ and $c^1$ elements for solving the Cahn-Hilliard equation. Journal of Computational Physics, 236(0):74 – 80, 2013.

M. R. Tonks, P. C. Millett, P. Nerikar, S. Du, D. Andersson, C. R. Stanek, D. Gaston, D. Andrs, and R. Williamson. Multiscale development of a fission gas thermal conductivity model: Coupling atomic, meso and continuum level simulations. J. Nuclear Materials, 440:193–200, 2013.

L. Guo, H. Huang, D. Gaston, C. Permann, D. Andrs, G. Redden, C. Lu, D. Fox, and Y. Fujita. A parallel fully coupled fully implicit solution to reactive transport in porous media using preconditioned Jacobian-Free Newton-Krylov method. Advances in Water Resources, 53:101–108, March 2013.

K. Chockalingam, M. R. Tonks, J. D. Hales, D. R. Gaston, P. C. Millett, and L. Zhang. Crystal plasticity with Jacobian-free Newton–Krylov. Computational Mechanics, pages 1–11, 2012.

R. L. Williamson, J. D. Hales, S. R. Novascone, M. R. Tonks, D. R. Gaston, C. J. Permann, D. Andrs, and R. C. Martineau. Multidimensional multiphysics simulation of nuclear fuel behavior. J. Nuclear Materials, 423:149–163, 2012.

J. D. Hales, S. R. Novascone, R. L. Williamson, D. R. Gaston, and M. R. Tonks. Solving nonlinear solid mechanics problems with the Jacobian-free Newton Krylov method. CMES: Comput. Model. Eng. Sci., 84(2):123–154, 2012.

M. Tonks, D. Gaston, P. Millett, D. Andrs, and P. Talbot. An object-oriented finite element framework for multiphysics phase field simulations. Comp. Mat. Sci., 51(1):20–29, 2012.

D. Gaston, L. Guo, G. Hansen, H. Huang, R. Johnson, H. Park, R. Podgorney, M. Tonks, and R. Williamson. Parallel algorithms and software for nuclear, energy, and environmental applications part i: Multiphysics algorithms. Communications in Computational Physics, 12(INL/JOU-10-20006):807–833, 2012.

D. Gaston, L. Guo, G. Hansen, H. Huang, R. Johnson, D. Knoll, C. Newman, H. Park, R. Podgorney, M. Tonks, and R. Williamson. Parallel algorithms and software for nuclear, energy, and environmental applications. part ii: Multiphysics software. Communications in Computational Physics, 12(INL/JOU-10-25162):834–865, 2012.

M. Tonks, D. Gaston, C. Permann, P. Millett, G. Hansen, and D. Wolf. A coupling methodology for mesoscale-informed nuclear fuel performance codes. Nucl. Eng. Design, 240:2877–83, 2010.

H. Park, D. A. Knoll, D. R. Gaston, and R. C. Martineau. Tightly coupled multiphysics algorithms for pebble bed reactors. Nuclear Science and Engineering, 166(2):118–133, 2010.

M. Tonks, D. Gaston, C. Permann, P. Millett, G. Hansen, and D. Wolf. A coupling methodology for mesoscale-informed nuclear fuel performance codes. Nucl. Engrg. Design, 240(10):2877–2883, 2010.

D. Gaston, G. Hansen, S. Kadioglu, D. Knoll, C. Newman, H. Park, C. Permann, and W. Taitano. Parallel multiphysics algorithms and software for computational nuclear engineering. Journal of Physics: Conference Series, 180(1):012012, 2009.

M. R. Tonks, G. Hansen, D. Gaston, C. Permann, P. Millett, and D. Wolf. Fully-coupled engineering and mesoscale simulations of thermal conductivity in $UO_2$ fuel using an implicit multiscale approach. Journal of Physics: Conference Series, 180(1):012078, 2009.

D. Gaston, C. Newman, G. Hansen, and D. Lebrun-Grandié. MOOSE: A parallel computational framework for coupled systems of nonlinear equations. Nucl. Eng. Design, 239:1768–1778, 2009.

C. Newman, G. Hansen, and D. Gaston. Three dimensional coupled simulation of thermomechanics, heat, and oxygen diffusion in $UO_2$ nuclear fuel rods. J. Nuclear Materials, 392:6–15, 2009.

## Technical Reports

D. Andrs, R. Berry, D. Gaston, R. Martineau, J. Peterson, H. Zhang, H. Zhao, and L. Zou. RELAP-7 level 2 milestone report: Demonstration of a steady state single phase PWR simlulation with RELAP-7. Technical report, Technical report, Idaho National Laboratory, 2012.

## Conference Papers

D. Gaston, J. Peterson, C. Permann, D. Andrs, A. Slaughter, and J. Miller. Continuous integration for concurrent computational framework and application development. In Workshop On Sustainable Software for Science: Practice and Experiences (WSSSPE), Supercomputing 2013, Denver, CO, Nov 17 2013.

D. R. Gaston, C. J. Permann, D. Andrs, and J. W. Peterson. Massive Hybrid Parallelism For Fully Implicit Multiphysics. In Proceedings of the International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering, Sun Valley, Idaho, May 5-9, 2013.

J. D. Hales, D. Andrs, and D. R. Gaston. Algorithms for thermal and mechanical contact in nuclear fuel performance analysis. In Proceedings of the International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering, Sun Valley, Idaho, May 5-9, 2013.

F. N. Gleicher, Y. Wang, D. Gaston, and R. C. Martineau. The method of manufactured solutions for RattleSnake, a SN radiation transport solver inside the MOOSE framework. Transactions of American Nuclear Society, 106(1):372–374, 2012.

D. Gaston and C. Permann. Modeling and simulation at INL. Mississippi State University, Starkville, MS, Nov 29 2011.

D. Gaston, C. Permann, D. Andrs, and J. Peterson. MOOSE workshop. Argonne National Laboratory, Lemont, IL, Oct 11-13 2011.

R. Podgorney, H. Huang, and D. Gaston. Massively parallel fully coupled implicit modeling of coupled thermal-hydrological-mechanical processes for enhanced geothermal system reservoirs. In Proceedings, 35th Stanford Geothermal Workshop, Stanford University, Palo Alto, CA, Feb 1-3 2010.

D. Gaston, C. Newman, and G. Hansen. MOOSE: a parallel computational framework for coupled systems of nonlinear equations. In American Nuclear Society 2009 International Conference on Advances in Mathematics, Computational Methods, and Reactor Physics, Saratoga Springs, NY, May 3–7 2009.

G. Hansen, C. Newman, D. Gaston, and C. Permann. An implicit solution framework for reactor fuel performance simulation. In 20th International Conference on Structural Mechanics in Reactor Technology (SMiRT 20), paper 2045, Espoo (Helsinki), Finland, August 9–14 2009.

G. Hansen, R. Martineau, C. Newman, and D. Gaston. Framework for simulation of pellet cladding thermal interaction (PCTI) for fuel performance calculations. In American Nuclear Society 2009 International Conference on Advances in Mathematics, Computational Methods, and Reactor Physics, Saratoga Springs, NY, May 3–7 2009.

C. Newman, D. Gaston, and G. Hansen. Computational foundations for reactor fuel performance modeling. In American Nuclear Society 2009 International Conference on Advances in Mathematics, Computational Methods, and Reactor Physics, Saratoga Springs, NY, May 3–7 2009.

H. Park, D. Gaston, S. Kadioglu, D. Knoll, R. Martineau, W. Taitano, and D. Lebrun-Grandie. Tightly coupled multiphysics simulations for pebble bed reactors. In American Nuclear Society 2009 International Conference on Advances in Mathematics, Computational Methods, and Reactor Physics, Saratoga Springs, NY, May 3–7 2009.

## Invited Talks

D. Gaston, C. Permann, D. Andrs, J. Peterson, and A. Slaughter. MOOSE workshop. Texas A&M University, College Station, TX, Oct 29-31 2013.

D. Gaston, C. Permann, D. Andrs, J. Peterson, and A. Slaughter. MOOSE workshop. Commonwealth Scientific and Industrial Research Organisation (CSIRO), Perth, Australia, Jun 11-13 2013.

D. Gaston, C. Permann, D. Andrs, J. Peterson, A. Slaughter, et al. Full core reactor simulation using MOOSE. In Closing Plenary, American Nuclear Society GLOBAL 2013, Salt Lake City, UT, Sept 29-October 3 2013.

D. R. Gaston, C. J. Permann, D. Andrs, J. W. Peterson, A. Slaughter, et al. Multiphysics, multiscale algorithms for nuclear power applications. In Plenary, International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering, Sun Valley, Idaho, May 5 2013.

D. Gaston, C. Permann, D. Andrs, and J. Peterson. MOOSE workshop. Argonne National Laboratory, Lemont, IL, Jan 14-16 2013.

D. Gaston, C. Permann, D. Andrs, and J. Peterson. MOOSE workshop. National Nuclear Laboratory, Preston, Lancashire, England, Aug 29-31 2012.

D. Gaston. Massively parallel multiphysics simulation of complex processes. American Association for the Advancement of Science (AAAS), Pacific Division Annual Meeting, Boise, ID, June 26 2012.

D. Gaston, C. Permann, D. Andrs, and J. Peterson. MOOSE workshop. Mississippi State University, Starkville, MS, April 10-12 2012.

D. Gaston, C. Permann, D. Andrs, and J. Peterson. Multiphysics simulation at INL. University of Idaho, Moscow, ID, January 10-12 2012.

D. Gaston, C. Permann, D. Andrs, and J. Peterson. MOOSE workshop. Massachusetts Institute of Technology, Boston, MA, January 10-12 2012.

D. Gaston, C. Permann, D. Andrs, J. Peterson, M. Tonks, J. Hales, R. Williamson, and L. Guo. Massively parallel multi-physics simulation using an object-oriented framework. In The Second Annual CAES Workshop on Modeling, Simulation and Visualization, Boise, ID, Sep 8-9 2011.

D. Gaston, C. Permann, C. Newman, G. Hansen, H. Huang, R. Park, D. Knoll, and R. Martineau. MOOSE: Multiphysics object oriented simulation environment. In Bettis Atomic Power Laboratory, Pittsburgh, PA, Oct 14 2009.

D. Gaston, C. Newman, G. Hansen, and C. Permann. MOOSE: A parallel computational framework for coupled systems of nonlinear equations. In Oregon State University Department of Nuclear Engineering, Corvalis, OR, July 9 2009.

D. Gaston, C. Newman, and G. Hansen. MOOSE: A parallel computational framework for coupled systems of nonlinear equations. In Sandia National Laboratories Computer Science Research Institute (CSRI), Albuquerque, NM, February 4 2009.

C. Newman, G. Hansen, and D. Gaston. Fully coupled solution methods for nuclear fuel performance analysis. In Los Alamos National Laboratory Center for Nonlinear Studies (CNLS), Los Alamos, NM, February 2 2009.

C. Newman, G. Hansen, and D. Gaston. Fully coupled solution methods for nuclear fuel performance analysis. In University of Arizona Department of Mechanical Engineering, Tucson, AZ, February 12 2009.

C. Newman and D. Gaston. Mathematical and computational foundations for fuel performance modeling. In Idaho National Laboratory Center for Nuclear Systems Design and Analysis Seminar Series, Idaho Falls, ID, August 21 2008.

D. Gaston, G. Hansen, C. Newman, and D. Knoll. MOOSE: Multiphysics object oriented simulation environment. In Électricité de France (EDF) Clamart, Paris, France, December 3 2008.

# Conference Talks

D. Gaston, M. Tonks, L. Guo, and Y. Wang. Solution methods for phase field methods with arbitrary numbers of variables. In SIAM Conference on Computational Science and Engineering, SIAM CS&E13, Boston, MA, Feb 25–Mar 1 2013.

D. Gaston, C. Permann, D. Andrs, and J. Peterson. Massive hybrid parallelism for fully implicit multiphysics. In SIAM Conference on Computational Science and Engineering, SIAM CS&E13, Boston, MA, Feb 25–Mar 1 2013.

P. Millett, D. Gaston, B. Biner, D. Andersson, C. Stanek, and R. Williamson. Multiscale simulation of the effect of radiation damage on reactor fuel performance. In International Workshop on Computational Mechanics of Materials, Baltimore, MD, Sep 24–26 2012.

L. Guo, C. Lu, H. Huang, and D. Gaston. Using a parallel fully-coupled simulator based on preconditioned jacobian-free newton-krylov. In XIXth International Conference on Computational Methods in Water Resources, CMWR XIX, Champaign, IL, June 17-21 2012.

M. Tonks, D. Gaston, P. Millett, D. Andersson, and C. Stanek. Multiscale fuel performance modeling: Coupling atomic, meso and continuum level simulations. In ANS, Chicago, IL, June 2012.

M. Tonks, P. Millett, R. Williamson, S. Novascone, J. Hales, D. Gaston, and D. Andrs. Multiscale modeling of reactor fuel restructuring. In TMS Annual Meeting, Orlando, FL, March 2012.

M. Tonks, D. Gaston, P. Millett, C. Permann, and D. Andrs. An object-oriented finite element framework for multiphysics phase field simulations. In SIAM Parallel Processing for Scientific Computing, Savannah, GA, Feb 15–17 2012.

D. Gaston, C. Permann, D. Andrs, and J. Peterson. Hybrid parallelism for massive scale, fully coupled, fully implicit multiphysics simulation. In SIAM Parallel Processing for Scientific Computing, Savannah, GA, Feb 15–17 2012.

M. Tonks, P. Millett, D. Gaston, D. Andersson, P. Nerikar, B. Beeler, C. Deo, and C. Stanek. Multiscale modeling of metallic reactor fuels. In 11th US National Congress on Computational Mechanics, USNCCM11, Minneapolis, MN, Jul 2011.

J. Hales, D. Andrs, D. Gaston, S. Novascone, C. Permann, M. Tonks, and R. Williamson. Fully coupled, implicit, 3-d, multiphysics for analysis of nuclear fuel. In 11th US National Congress on Computational Mechanics, USNCCM11, Minneapolis, MN, 2011.

M. Tonks, P. Millett, D. Gaston, D. Andersson, P. Nerikar, and C. Stanek. Development of multiscale materials models for lwr fuel performance codes. In SIAM Conference on Computational Science and Engineering 2011, SIAM CSE11, Reno, NV, Mar 2011.

M. Tonks, P. Millett, D. Gaston, D. Andersson, P. Nerikar, and C. Stanek. Development of multiscale materials models for lwr fuel performance codes. In TMS Annual Meeting, San Diego, CA, Mar 2011.

L. Guo, H. Huang, D. Gaston, G. Redden, D. Fox, and Y. Fujita. Reactive transport modeling of induced calcite precipitation reaction fronts in porous media using a parallel, fully coupled, fully implicit approach. In AGU Fall Meeting, San Francisco, CA, Dec 13-17 2010.

D. Gaston. Moose. In 9th World Congress on Computational Mechanics, Sydney, Australia, July 18–23 2010.

M. Tonks, D. Gaston, and P. Millett. Phase field simulations of irradiation-induced microstructure evolution. In SIAM Annual Meeting, Pittsburgh, PA, July 2010.

M. Tonks, D. Gaston, and P. Millett. Modeling irradiation-induced microstructure evolution with a finite element phase field model. In Spring MRS Meeting, San Francisco, CA, Apr 2010.

H. Huang, L. Guo, D. Gaston, Z. Xu, G. Redden, D. Fox, and Y. Fujita. Reactive transport modeling ureolytic calcite precipitation using a parallel, fully-coupled, fully-implicit approach. In DOE-ERSP 5th Annual PI Meeting, Washington, DC, 2010.

M. Tonks, D. Gaston, and P. Millett. Finite element irradiated microstructure phase field model. In TMS Annual Meeting, Seattle, WA, Feb 2010.

D. Gaston and C. Permann. Hybrid parallelism for preconditioned jacobian-free newton-krylov. In SIAM Conference on Parallel Processing for Scientific Computing, PP10, Seattle, Washington, February 24–26 2010.

L. Guo, H. Huang, D. Gaston, and G. Redden. Modeling of calcite precipitation driven by bacteria-facilitated urea hydrolysis in a flow column using a fully coupled, fully implicit parallel reactive transport simulator. In Eos Transactions American Geophysical Union, 90(52), Fall Meeting Supplement., AGU 90(52), San Francisco, CA, Dec 14-18 2009.

G. Hansen, C. Newman, and D. Gaston. Mesh generation and adaptation using the laplace-beltrami target metric. In Monge-Kantorovich Optimal Transport –Theory and Applications, Santa Fe, New Mexico, Oct 19 2009.

C. Newman, G. Hansen, and D. Gaston. Finite element solutions of the monge–kantorovich problem. In Monge-Kantorovich Optimal Transport –Theory and Applications, Santa Fe, New Mexico, Oct 19 2009.

D. Gaston, G. Hansen, and C. Newman. MOOSE: A parallel computational framework for coupled systems of nonlinear equations. In 2009 International Conference on Advances in Mathematics, Computational Methods, and Reactor Physics, MC09, Saratoga Springs, New York, May 4 2009.

C. Newman, D. Gaston, and G. Hansen. Computational foundations for reactor fuel performance modeling. In 2009 International Conference On Advances In Mathematics, Computational Methods, And Reactor Physics, Mc09, Saratoga Springs, New York, May 5 2009.

M. Tonks, D. Gaston, and P. Millett. Fully-coupled engineering and mesoscale simulations of heat conduction in uo2 fuel using an implicit multiscale approach. In Fall MRS Meeting, Boston, MA, Nov 2009.

G. Hansen, R. Martineau, C. Newman, and D. Gaston. Framework for simulation of pellet/cladding thermal interaction (pcti) for fuel performance calculations. In 2009 International Conference on Advances in Mathematics, Computational Methods, and Reactor Physics, MC09, Saratoga Springs, New York, May 4 2009.

C. Newman, G. Hansen, and D. Gaston. Multiphysics, multiscale methods for nuclear fuel performance. In SIAM Conference on Computational Science and Engineering, CSE09, Miami, FL, March 3 2009.

M. Tonks, D. Gaston, and P. Millett. Fully-coupled engineering and mesoscale simulations of thermal conductivity in uo2 fuel using an implicit multiscale approach. In The 8th Materials Modeling and Simulation for Nuclear Fuels Workshop, Albuquerque, NM, Sep 2009.