

**University of Montana Faculty Vita**  
**Johnathan M. Bardsley**  
 Professor of Mathematics

**EDUCATION:**

2002	Ph.D.	Mathematics	Montana State University
1999	M.S.	Mathematics	University of Oregon
1998	M.S.	Mathematics	Montana State University
1996	B.S.	Mathematics	Montana Tech of the University of Montana

**EXPERIENCE:**

June 2015–present	Grievance Officer	University Faculty Association Faculty Union, The University of Montana
August 2013–present	Full Professor	Department of Mathematical Sciences The University of Montana
June 2011, 2012, 2013 May 2014	Visiting Professor (2-3 weeks/year)	Division of Physical Sciences Lappeenranta University of Technology Lappeenranta, Finland
August 2010–June 2011	Visiting Professor (1 year)	Department of Physics The University of Otago Dunedin, New Zealand
August 2009–present	Tenured	Department of Mathematical Sciences The University of Montana
August 2008–August 2010	Co-Director	Montana Ecology of Infectious Disease NSF-IGERT PhD Program The University of Montana
August 2007–August 2013	Associate Professor	Department of Mathematical Sciences The University of Montana
August 2006–July 2007	Visiting Professor (1 year)	Department of Mathematics and Statistics The University of Helsinki Helsinki, Finland
August 2003–August 2007	Assistant Professor	Department of Mathematical Sciences The University of Montana
August 2002–July 2003	Postdoctoral Fellow	Statistical and Applied Mathematical Sciences Institute
August 2002–July 2003	Postdoctoral Fellow	Center for Research in Scientific Computation, North Carolina State University
2000–2002	Research Assistant	Montana State University
Summer 2001	Teaching Assistant	Montana State University
1998–1999	Teaching Assistant	University of Oregon
1996–1998	Teaching Assistant	Montana State University

**AWARDS:**

*Chancellor’s Medallion, Montana Tech of the University of Montana, 2017.*

Description from Montana Tech web site: This award is given at the sole discretion of the Chancellor to recognize an alumnus who has excelled in both their educational and professional careers. The award recipients will have earned at least one degree from Montana Tech and will have made significant academic related contributions including professional publications, holding faculty positions, advising graduate students, and participating in academic research.

*Math Department, Montana Tech of the University of Montana, Distinguished Alumni Award, 2004.*

## RESEARCH INTERESTS:

Inverse Problems, Uncertainty Quantification, Computational Mathematics and Statistics, Imaging

## GRANT ACTIVITY:

National Science Foundation, DMS-1519021, “Montana Workshop on Uncertainty Quantification,” June 2015, The University of Montana. Amount: \$19,300.

National Security Technologies, LLC, Site Directed Research and Development Program, under Contract No. DE-AC52-06NA25946 with the U.S. Dept. of Energy, October 1, 2015-September 30, 2016. Amount: \$39,948. Title: “Theoretical and Computational Uncertainty Quantification for Poisson-based Inverse Problems in Radiography.”

National Security Technologies, LLC, Site Directed Research and Development Program, under Contract No. DE-AC52-06NA25946 with the U.S. Dept. of Energy, October 1, 2014-September 30, 2015. Amount: \$72,200. Title: “Bayesian Theory for Poisson Data.”

National Security Technologies, LLC, Site Directed Research and Development Program, under Contract No. DE-AC52-06NA25946 with the U.S. Dept. of Energy, October 1, 2013-September 30, 2014. Amount: \$74,442. Title: “Markov Chain Monte Carlo Methods for Poisson-Based Sampling.”

National Security Technologies, LLC, Site Directed Research and Development Program, under Contract No. DE-AC52-06NA25946 with the U.S. Dept. of Energy, October 1, 2012-September 30, 2013. Amount: \$65,000. Title: “Maximum Likelihood Estimation and Uncertainty Quantification for Signals with Poisson-Gaussian Mixed Noise.”

NSF DMS-0915107, *Computational Methods for Positron Emission Tomography*, September 1, 2009-August 31-2011. Amount: \$87,404.

NSF-EPSCoR Ph.D. Graduate Student Fellowship, for a UM-Math graduate student to work on research related to Large River Ecosystems, August 2008-August 2010. Amount: \$58,000.

NSF-DMS 0504325, with Emily Stone, *Archetypal Analysis of 2D Patterns in Emergent Distributed Computation*, July 2006-July 2008. Amount: \$116,299.00.

University of Montana Grant MRA-702, *Parameter Estimation for Chemical Kinetics*. Awarded in April 2006. Amount: \$2,500.

University of Montana Grant MRA-682, *Computational Methods for an Image Deblurring Problem Arising in Astronomical Imaging, Continued*, \$3,125 award.

University of Montana Grant MRA-353, *Computational Methods for an Image Deblurring Problem Arising in Astronomical Imaging*, \$5000 award.

## Ph.D. STUDENTS (all at UM):

5. Kevin Joyce (May 2016; co-advised with Aaron Luttmann). Thesis topic: *Point Spread Function Estimation and Uncertainty Quantification*.
4. Marylesa Howard (May 2013). Thesis title: *Computational Methods for Support Vector Machine Classification and Large-Scale Kalman Filtering*.
3. John Goldes (May 2010). Thesis title: *Regularization Parameter Selection Methods for Ill-Posed Poisson Likelihood Estimation*.
2. N'djekornom Dara Laobeul (May 2008). Thesis title: *Regularization Methods for Ill-Posed Poisson Likelihood Estimation*.
1. Aaron Luttmann (May 2006; co-advised with Emily Stone). Thesis title: *A Three-Dimensional Variational Approach to Video Segmentation*.

**REFEREED PUBLICATIONS** ([www.math.umd.edu/bardsley/publications.html](http://www.math.umd.edu/bardsley/publications.html)):

47. "Bayesian inverse problems with l1 priors: a Randomize-then-Optimize approach," with Zheng Wang, Antti Solonen, Tiangang Cui, Youssef M. Marzouk, accepted in *SIAM Journal on Scientific Computing*.
46. "A Metropolis-Hastings method for linear inverse problems with Poisson likelihood and Gaussian prior," with Aaron Luttmann, *International Journal of Uncertainty Quantification*, vol. 6, iss. 1, pp. 35-55, 2016.
45. "Randomize-then-optimize for sampling and uncertainty quantification in electrical impedance tomography," with Aku Seppänen, Antti Solonen, Heikki Haario, and Jari Kaipio, *SIAM Journal on Uncertainty Quantification*, Vol. 3, pp. 11361158, 2015.
44. "Dealing with Boundary Artifacts in MCMC-Based Deconvolution," with Aaron Luttmann, *Linear Algebra and its Applications*, vol. 473, pp. 339358, 2015.
43. "Analysis of the Gibbs sampler for hierarchical inverse problems," with Sergios Agapiou, Omiros Paspaliopoulos, and Andrew M. Stuart, *SIAM Journal on Uncertainty Quantification*, vol. 2, iss. 1, pp. 511-544, 2014.
42. "Randomize-then-Optimize: a method for sampling from posterior distributions in nonlinear inverse problems," with Antti Solonen, Heikki Haario, and Marko Laine, *SIAM Journal on Scientific Computing*, Volume 36, Issue 4, pp. A1359-C399, 2014.
41. "Consequences of a refuge for the predator-prey dynamics of a wolf-elk system in Banff National Park, Alberta, Canada," with Joshua Goldberg and Mark Hebblewhite, *PLoS ONE*, 9(3), 2014: e91417. doi:10.1371/journal.pone.0091417.
40. "Optimization-based Sampling for the Ensemble Kalman filter," with Antti Solonen, Alexander Bibov, and Heikki Haario, *International Journal for Uncertainty Quantification*, vol. 4, iss. 4, pp. 349-364, 2014.
39. "Efficient MCMC-Based Image Deblurring with Neumann Boundary Conditions," with Marylesa Howard and Jim Nagy, *Electronic Transactions in Numerical Analysis*, vol. 40, 2013, pp. 476 - 488.
38. "Gaussian Markov Random Field Priors for Inverse Problems," *Inverse Problems and Imaging*, vol. 7, no. 2, 2013, pp. 397-416.
37. "An ensemble Kalman filter using the conjugate gradient sampler," with Antti Solonen, Albert Parker, Heikki Haario, and Marylesa Howard, *International Journal for Uncertainty Quantification*, Vol. 3, No. 4, 2013, pp. 357-370
36. "Laplace-distributed increments, the Laplace prior, and edge-preserving regularization," *Journal of Inverse and Ill-Posed Problems*, Vol. 20, No. 3, 2013, pp. 271-285.
35. "Krylov space approximate Kalman filtering," with Albert Parker, Antti Solonen, and Marylesa Howard, *Numerical Linear Algebra with Applications*, Vol. 20, 2013, pp. 171-184.
34. "MCMC-Based Image Reconstruction with Uncertainty Quantification," *SIAM Journal on Scientific Computing*, Vol. 34, No. 3, 2012, pp. A1316-A1332.
33. "An MCMC Method for Uncertainty Quantification in Nonnegativity Constrained Inverse Problems," with Colin Fox, *Inverse Problems in Science and Engineering*, Vol. 20, No. 4, 2012, pp. 477-498.
32. "Applications of a Nonnegatively Constrained Iterative Method with Statistically Based Stopping Rules to CT, PET, and SPECT Imaging", *Electronic Transactions in Numerical Analysis*, 38, 2011, pp. 34-43.
31. "Techniques for regularization parameter and hyper-parameter selection in PET and SPECT Imaging", with John Goldes, *Inverse Problems in Science and Engineering*, 19(2), 2011, p. 267.

30. "A Computational Framework for Total Variation-Regularized Positron Emission Tomography", with John Goldes, *Numerical Algorithms*, 57(2), 2011, p. 255.
29. "Structured Linear Algebra Problems in Adaptive Optics Imaging", with Sarah Knepper and Jim Nagy, *Advances in Computational Mathematics*, 5(2-4), 2011, pp. 103-117.
28. "Hierarchical Regularization for Edge-Preserving Reconstruction of PET Images", with Daniela Calvetti and Erkki Somersalo, *Inverse Problems*, 26 (2010), 035010.
27. "Regularization Parameter Selection Methods for Ill-Posed Poisson Maximum Likelihood Estimation", with John Goldes, *Inverse Problems*, 25(9) (2009), 095005.
26. "Large-Scale Kalman Filtering Using the Limited Memory BFGS Method", with H. Auvinen, H. Haario, and T. Kauranne, *Electronic Transactions in Numerical Analysis*, Vol. 35, 2009, pp. 217-233.
25. "A Theoretical Framework for the Regularization of Poisson Likelihood Estimation Problems," *Inverse Problems and Imaging*, Vol. 4, No. 1, February 2010 pp. 11-17.
24. "The variational Kalman filter and an efficient implementation using limited memory BFGS", with H. Auvinen, H. Haario, and T. Kauranne, *International Journal for Numerical Methods in Fluids*, 64, 3, pp. 314-335, 2010.
23. "An Iterative Method for Edge-Preserving MAP Estimation when Data-Noise is Poisson," with John Goldes, *SIAM Journal on Scientific Computing*, Vol.32, No.1, published online Feb 5, 2010.
22. "A Fixed Point Formulation of the k-Means Algorithm and a Connection to Mumford-Shaw", with Aaron Luttman, *Applied Math E-Notes*, vol. 9, 2009, pp. 274-276.
21. "Stopping Rules for a Nonnegatively Constrained Iterative Method for Ill-Posed Poisson Imaging Problems," *BIT Numerical Mathematics*, Volume 48, Number 4, December, 2008, pp. 651-664.
20. "An Analysis of Regularization by Diffusion for Ill-Posed Poisson Likelihood Estimation," with N'djekornom Laobeul, *Inverse Problems in Science and Engineering*, Volume 17, Issue 4, June 2009 , pp. 537 - 550.
19. "Total Variation-Penalized Poisson Likelihood Estimation for Ill-Posed Problems," with Aaron Luttman, *Advances in Computational Mathematics*, Volume 31, Issue 1, (2009), Page 35-59.
18. "An Efficient Computational Method for Total Variation-Penalized Poisson Likelihood Estimation," *Inverse Problems and Imaging*, vol. 2, no. 2, 2008, pp. 167 - 185.
17. "The Stabilizing Properties of Nonnegativity Constraints in Least-Squares Image Reconstruction," with Jorma Merikoski and Roberto Vio, *International Journal of Pure and Applied Mathematics*, vol. 43, no. 1, 2008, pp. 95-109.
16. "An Analysis of Methods for Wavefront Reconstruction From Gradient Measurements in Adaptive Optics," *International Journal of Pure and Applied Mathematics*, Vol. 42, No. 1, 2008, pp. 71-81.
15. "Tikhonov Regularized Poisson Likelihood Estimation: Theoretical Justification and a Computational Method," with N'djekornom Dara Laobeul, *Inverse Problems in Science and Engineering*, Volume 16, Issue 2 January 2008 , pp. 199 - 215.
14. "Wavefront Reconstruction Methods for Adaptive Optics Systems on Ground-Based Telescopes," *SIAM Journal on Matrix Analysis and Applications*, Volume 30 Issue 1, 2008, pp. 67-83.
13. "An Efficient Estimation Scheme for Phase-Diversity Time Series Data," *IEEE Transactions on Image Processing*, volume 17, issue 1, 2008, pp. 9-15.
12. "Analysis of Pattern Formation on the Surface of Respiring Leaves," with Aaron Luttman and Emily Stone, *Physica D*, Vol 232, Issue 2, 2007, pp. 142-155.

11. “A Variational Approach to Image Segmentation for Botanical Data,” with Aaron Luttman, *SIAM Journal on Scientific Computing*, Vol 29, Issue 4, 2007, pp. 1550-1566. Erratum in SISC Vol 30, Issue 1, pp. 548.
10. “A Computational Method for the Restoration of Images With an Unknown, Spatially-Varying Blur,” with Stuart Jeffries, Jim Nagy and Bob Plemmons, *Optics Express*, vol. 14, Iss. 5, 2006, pp. 1767-1782.
9. “Covariance-Preconditioned Iterative Methods for Nonnegatively Constrained Astronomical Imaging,” with Jim Nagy, *SIAM Journal on Matrix Analysis and Applications*, Vol. 27, No. 4, 2006, pp. 1184-1198.
8. “Dealing with edge effects in least-squares image deconvolution problems,” with R. Vio, M. Donatelli, and W. Wamsteker, *Astronomy and Astrophysics*, vol. 442, pp. 397-403, 2005.
7. “A Nonnegatively Constrained Trust Region Algorithm for the Restoration of Images with an Unknown Blur,” *Electronic Transactions in Numerical Analysis*, vol. 20, 2005, pp. 139-153.
6. “Least-Squares methods with Poissonian noise: analysis and a comparison with the Richardson-Lucy algorithm,” with R. Vio and W. Wamsteker, *Astronomy and Astrophysics*, vol. 436, 2005, pp. 741-755.
5. “Wellposedness for Systems Arising in Time Domain Electromagnetics in Dielectrics,” with H. T. Banks, *International Journal of Pure and Applied Mathematics*, 46 (2008), no. 1, 1–18.
4. “Parameter Identification for a Dispersive Dielectric in 2D Electromagnetics: Forward and Inverse Methodology with Statistical Considerations,” with H. T. Banks, *International Journal of Computational and Numerical Analysis and Applications*, vol. 5, No. 1, 2004, pp. 13–49.
3. “A Limited Memory, Quasi-Newton Preconditioner for Nonnegatively Constrained Image Reconstruction,” *Journal of the Optical Society of America A*, vol. 21, no. 5, 2004, pp. 13–49.
2. “A Nonnegatively Constrained Convex Programming Method for Image Reconstruction,” with C. R. Vogel, *SIAM Journal on Scientific Computing*, vol. 25, no. 4, 2004, pp. 1326-1343.
1. “Computational Methods for a Large-Scale Inverse Problem Arising in Atmospheric Optics,” with C. R. Vogel and Luc Gilles, *Inverse Problems*, vol. 18, 2002, pp. 237-252.

#### PRESENTATIONS ON RESEARCH AND MINI-SYMPOSIA AND CONFERENCE ORGANIZATION

46. *SIAM Conference on Computational Science and Engineering*, March 2017.
45. *Plenary Lecture, Optimization: Inverse Problems Workshop, SAMSI*, January 2017.
44. *Technical University Denmark*, two talks at the Uncertainty in Image Reconstruction Workshop, December 2016.
43. *Massachusetts Institute of Technology*, Uncertainty Quantification Group Seminar Series, November 2016.
42. *SIAM Conference on Imaging Science*, May 2016.
41. *Copper Mountain Conference on Iterative Methods*, March 2016.
40. ★ *Montana Uncertainty Quantification, Conference Co-organizer* with Aaron Luttman, University of Montana, 23 participants, June 24-26, 2015.
39. Mathematics Seminar, University College Cork, April 2015.
38. *SIAM Conference on Computational Science and Engineering, Two-part mini-symposium organizer (with Aaron Luttman)* and speaker, Salt Lake City, Utah, March 2015.

37. *Meeting of the Pacific Northwest Chapter of the Mathematics Association of America*, **Two-part mini-symposium organizer** and speaker, Missoula, Montana, June 2014.
36. *SIAM Conference on Uncertainty Quantification*, **Three-part mini-symposium organizer** and speaker, Savannah, GA, April 2014.
35. *SIAM Conference on Control and Its Applications*, San Diego, California, July 2013.
34. *Radiography Analysis Group Meeting*, National Security Technologies, LLC, Las Vegas, Nevada, April 2013.
33. *Southern Uncertainty Quantification Conference*, University of Otago, Dunedin, New Zealand, January 2013.
32. *Oberwolfach, Workshop on Computational Inverse Problems*, Oberwolfach, Germany, October 2012.
31. *University of Warwick, Computational Math Seminar*, Coventry, England, June 2012.
30. *SIAM Conference on Uncertainty Quantification*, **Two-part mini-symposium organizer** and speaker, Raleigh, NC, April 2012.
29. *Applied Math Seminar*, Department of Mathematical Sciences, Montana State University, March 2012.
28. *Emory University, Computational Math Seminar*, Atlanta, invited speaker, November 2011.
27. *International Congress on Industrial and Applied Mathematics*, **Two-part mini-symposium organizer** and speaker, Vancouver, Canada, July 2011.
26. *Mathematics Colloquium Series, University of Otago*, Dunedin, New Zealand, March 30, 2011.
25. *Applied Mathematics Colloquium Series, University of Auckland*, Auckland, New Zealand, March 24, 2011.
24. *International Linear Algebra Society Conference*, Pisa, Italy, July 2010.
23. *SIAM Conference on Imaging Science*, speaker, Chicago, April 2010.
22. *Statistical Inference and Partial Differential Equations*, University of Otago, Dunedin, New Zealand, invited speaker, January 2010.
21. *Emory University, Computational Math Seminar*, Atlanta, invited speaker, November 2009. Talk title: Computational and Statistical Methods for Positron Emission Tomography.
20. *Emerging Methods in Inverse Problems*, Colorado State University, Fort Collins, July 2009, Talk title: Statistical Modeling Yields Opportunities in Inverse Problems.
19. *SIAM Annual Meeting*, **Two-part mini-symposium organizer** and speaker, Denver, Colorado, July 2009.
18. *Applied Math Seminar*, Department of Mathematical Sciences, Montana State University, April 2009.
17. *Colloquium Talk*, Department of Mathematics, Case Western Reserve University, November 2008.
16. *SIAM Conference on Imaging Science*, **Mini-symposium organizer** and speaker, San Diego, California, July 2008.
15. *International Linear Algebra Society Conference*, Cancun, Mexico, June 2008.
14. *Los Alamos National Lab, Data Driven Modeling and Analysis Group, Speaker Series*, Los Alamos, New Mexico, May 2008.
13. *Copper Mountain Conference on Iterative Methods*, Copper Mountain, Colorado, April 2008.

12. *International Conference on Industrial and Applied Mathematics*, Zurich, Switzerland, July 2007.
11. *International Conference on Preconditioning*, CERFACS, Toulouse, France, July 2007.
10. *Invited Lecture*, University of Jyväskylä, Jyväskylä, Finland, May 2007.
9. *Inverse Days*, Tampere University of Technology, Tampere Finland, December 2006.
8. *Inverse Problems Seminar*, University of Helsinki, Helsinki, Finland, October 2006.
7. *SIAM Conference on Imaging Science*, Minneapolis, MN, May 2006.
6. *International Conference on Preconditioning*, Emory University, Atlanta, May 2005.
5. *MAA Northwest Section Meeting*, University of Puget Sound, April 2005.
4. *SIAM Conference on Imaging Science*, Salt Lake City, May 2004.
3. *Applied Mathematics Seminar*, Montana State University, various times.
2. *Applied Math Seminar*, University of Montana, various times.
1. *SIAM Annual Meeting 2002*, Philadelphia, July 2002.

#### **TEACHING AT THE UNIVERSITY OF MONTANA:**

1. Math 171 (152), *Calculus I*, Spring 2005, Fall 2007.
2. Math 172, *Calculus II*, Spring 2010.
3. Math 181, *Honors Calculus I*, Fall 2009.
4. Math 182, *Honors Calculus II*, Spring 2010.
5. Math 274 (158), *Applied Differential Equations*, Spring 2006, 2008, 2009, 2014.
6. Math 221, *Linear Algebra*, Spring 2009, 2012, 2013, 2015; Fall 2011, 2012, 2013.
7. Math 311-17, *Ordinary Differential Equations and Computer Lab*, Fall 2003, 2004, 2005.
8. Math 412-18, *Partial Differential Equations and Computer Lab*, Spring 2004, 2005, 2006, 2015.
9. Math 414, *Deterministic Models*, Spring 2013, Spring 2014.
10. Math 471/440, *Numerical Analysis*, Spring 2004, Fall 2005, Fall 2008, Fall 2012, Fall 2014, Fall 2016.
11. Math 445, *Statistical, Dynamical, and Computational Modeling*, Fall 2008, Fall 2014, Fall 2015.
12. Math 514, *Topics in Applied Mathematics*
  - (a) *Numerical Partial Differential Equations*, Fall 2004;
  - (b) *Numerical Linear Algebra and Inverse Problems*, Fall 2007;
  - (c) *Computational and Statistical Inverse Problems*, Spring 2008;
  - (d) *Bayesian Scientific Computing*, Fall 2009;
  - (e) *Inverse Problems from a Statistical Viewpoint*, Fall 2011.
  - (f) *Numerical Linear Algebra*, Spring 2012.
  - (g) *Introduction to Computational Inverse Problems: Mathematical and Statistical Methods*, Fall 2013.
  - (h) *Computational Inverse Problems and Uncertainty Quantification*, Spring 2016.

**SERVICE AT THE UNIVERSITY OF MONTANA:**

1. Math Department service:
  - (a) Policy Committee: 2015-16.
  - (b) Graduate Committee: 2015-present, 2004-2006.
  - (c) Undergraduate Committee: 2007-2009, 2012-14.
  - (d) Computer Committee: 2003-2004, 2009-10 (chair).
  - (e) Faculty Evaluation Steering Committee: 2004, 2009 (chair), 2011 (chair), 2013.
  - (f) Colloquium Committee: 2012-15 (chair).
  - (g) Job search committee: 2007-08, 2003-04.
2. University-wide service:
  - (a) Grievance Officer, University Faculty Association UFA (our faculty union), 2015-present.
  - (b) Executive Board, University Faculty Association, 2014-present.
  - (c) Bargaining team for faculty contracts, UFA, 2014-15.
  - (d) Co-director, Montana Ecology of Infectious Disease, NSF-IGERT grand, August 2008-2012.
  - (e) Faculty Senate, 2013-15.
  - (f) Job search committee, Physics Department, 2009.

**SERVICE FOR MY RESEARCH COMMUNITY:**

1. I referee, on average, six journal articles per year, mainly in the areas of computational mathematics and statistics as applied to inverse problems.
2. I was a reviewer for three Finnish PhD dissertations: in 2011, 2014, and 2015.
3. I was a reviewer in 2011 for an application for the post of docent in applied inverse problems for a faculty member from the University of Eastern Finland.
4. I was a primary reviewer for a SIAM book in the spring of 2016.
5. I served on an NSF panel in the spring of 2016.