

University of Montana Faculty Vita

Johnathan M. Bardsley

Associate 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 3-25, 2011	Visiting Professor	Division of Physical Sciences Lappeenranta University of Technology Lappeenranta, Finland
August 2010–June 2011	Visiting Professor	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–present	Associate Professor	Department of Mathematical Sciences The University of Montana
August 2006–July 2007	Visiting Professor	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

GRANT ACTIVITY:

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):

1. Aaron Luttmann (May 2006). Thesis title: *A Three-Dimensional Variational Approach to Video Segmentation*.
2. N'djekornom Dara Laobeul (May 2008). Thesis title: *Regularization Methods for Ill-Posed Poisson Likelihood Estimation*.
3. John Goldes (May 2010). Thesis title: *Regularization Parameter Selection Methods for Ill-Posed Poisson Likelihood Estimation*.
4. Marylesa Howard (formerly Wilde, expected, May 2012). Thesis topic: *Numerical Methods for Statistical Problems*.

M.S. STUDENTS (all at UM):

1. Kira Heater (May 2005), Final project title: *The FDTD Method: Computation and Analysis*.
2. John Goldes (May 2007), Final project title: *Parameter Estimation for Fluorescence Anisotropy Decay*.
3. Marylesa Wilde (now Howard, May 2009), Final project title: *Computational Methods for Ground Classification in Remote Sensing*.

RESEARCH INTERESTS:

Inverse and Ill-Posed Problems, Image Processing and Analysis, Statistical Methods, Scientific Computing.

REFEREED PUBLICATIONS:

1. "An ensemble Kalman filter using the conjugate gradient sampler", with Antti Solonen, Albert Parker, Heikki Haario, and Marylesa Howard, accepted in *International Journal for Uncertainty Quantification*.
2. "An MCMC Method for Uncertainty Quantification in Nonnegativity Constrained Inverse Problems," with Colin Fox, accepted in *Inverse Problems in Science and Engineering*.
3. "Krylov space approximate Kalman filtering," with Albert Parker, Antti Solonen, and Marylesa Howard, accepted in *Numerical Linear Algebra with Applications*.
4. "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.

5. “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.
6. “A Computational Framework for Total Variation-Regularized Positron Emission Tomography”, with John Goldes, *Numerical Algorithms*, 57(2), 2011, p. 255.
7. “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.
8. “Hierarchical Regularization for Edge-Preserving Reconstruction of PET Images”, with Daniela Calvetti and Erkki Somersalo, *Inverse Problems*, 26 (2010), 035010.
9. “Regularization Parameter Selection Methods for Ill-Posed Poisson Maximum Likelihood Estimation”, with John Goldes, *Inverse Problems*, 25(9) (2009), 095005.
10. “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.
11. “A Theoretical Framework for the Regularization of Poisson Likelihood Estimation Problems,” *Inverse Problems and Imaging*, Vol. 4, No. 1, February 2010 pp. 11-17.
12. “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.
13. “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.
14. “A Fixed Point Formulation of the k-Means Algorithm and a Connection to Mumford-Shaw”, with Aaron Luttmann, *Applied Math E-Notes*, vol. 9, 2009, pp. 274-276.
15. “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.
16. “An Analysis of Regularization by Diffusion for Ill-Posed Poisson Likelihood Estimation,” with N’djekornom Laobeul, accepted in *Inverse Problems in Science and Engineering*, Volume 17, Issue 4, June 2009 , pp. 537 - 550.
17. “Total Variation-Penalized Poisson Likelihood Estimation for Ill-Posed Problems,” with Aaron Luttmann, *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.
19. “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.

20. "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.
21. "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.
22. "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.
23. "An Efficient Estimation Scheme for Phase-Diversity Time Series Data," *IEEE Transactions on Image Processing*, volume 17, issue 1, 2008, pp. 9-15.
24. "Analysis of Pattern Formation on the Surface of Respiring Leaves," with Aaron Luttmann and Emily Stone, *Physica D*, Vol 232, Issue 2, 2007, pp. 142-155.
25. "A Variational Approach to Image Segmentation for Botanical Data," with Aaron Luttmann, *SIAM Journal on Scientific Computing*, Vol 29, Issue 4, 2007, pp. 1550-1566. Erratum in *SISC* Vol 30, Issue 1, pp. 548.
26. "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.
27. "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.
28. "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.
29. "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.
30. "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.
31. "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.
32. "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.
33. "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.

34. "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.
35. "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 ORGANIZATION

1. *Emory University, Computational Math Seminar*, Atlanta, invited speaker, November 2011. Talk title: Gaussian Markov Random Field Priors and MCMC for Inverse Problems.
2. *International Congress on Industrial and Applied Mathematics*, **Two-part mini-symposium organizer** and speaker, Vancouver, Canada, July 2011.
3. *Mathematics Colloquium Series, University of Otago*, Dunedin, New Zealand, March 30, 2011.
4. *Applied Mathematics Colloquium Series, University of Auckland*, Auckland, New Zealand, March 24, 2011.
5. *International Linear Algebra Society Conference*, Pisa, Italy, July 2010.
6. *SIAM Conference on Imaging Science*, speaker, Chicago, April 2010.
7. *Statistical Inference and Partial Differential Equations*, University of Otago, Dunedin, New Zealand, invited speaker, January 2010. Talk title: Computational and Statistical Methods for Positron Emission Tomography.
8. *Emory University, Computational Math Seminar*, Atlanta, invited speaker, November 2009. Talk title: Computational and Statistical Methods for Positron Emission Tomography.
9. *Emerging Methods in Inverse Problems*, Colorado State University, Fort Collins, July 2009, Talk title: Statistical Modeling Yields Opportunities in Inverse Problems.
10. *SIAM Annual Meeting*, **Two-part mini-symposium organizer** and speaker, Denver, Colorado, July 2009.
11. *Applied Math Seminar*, Department of Mathematical Sciences, Montana State University, April 2009.
12. *Colloquium Talk*, Department of Mathematics, Case Western Reserve University, November 2008.
13. *SIAM Conference on Imaging Science*, **Mini-symposium organizer** and speaker, San Diego, California, July 2008.
14. *International Linear Algebra Society Conference*, Cancun, Mexico, June 2008.
15. *Los Alamos National Lab, Data Driven Modeling and Analysis Group, Speaker Series*, Los Alamos, New Mexico, May 2008.
16. *Copper Mountain Conference on Iterative Methods*, Copper Mountain, Colorado, April 2008.
17. *International Conference on Industrial and Applied Mathematics*, Zurich, Switzerland, July 2007.

18. *International Conference on Preconditioning*, CERFACS, Toulouse, France, July 2007.
19. *Invited Lecture*, University of Jyväskylä, Jyväskylä, Finland, May 2007.
20. *Inverse Days*, Tampere University of Technology, Tampere Finland, December 2006.
21. *Inverse Problems Seminar*, University of Helsinki, Helsinki, Finland, October 2006.
22. *SIAM Conference on Imaging Science*, Minneapolis, MN, May 2006.
23. *International Conference on Preconditioning*, Emory University, Atlanta, May 2005.
24. *MAA Northwest Section Meeting*, University of Puget Sound, April 2005.
25. *SIAM Conference on Imaging Science*, Salt Lake City, May 2004.
26. *Applied Mathematics Seminar*, Montana State University, various times.
27. *Applied Math Seminar*, University of Montana, various times.
28. *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, Spring 2008, Spring 2009.
6. Math 221, *Linear Algebra*, Spring 2009, Fall 2011.
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.
9. Math 471, *Numerical Analysis*, Spring 2004, Fall 2005, Fall 2008.
10. Math 495, *Computation, Numerical, and Statistical Modeling*, Fall 2008.
11. 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.