Benjamin E. Barrowes

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Education

PostDoc • **Los Alamos National Laboratory**. Director's funded post-doctoral appointee. Biological and Quantum Physics, P-21. Department of Energy Artificial Retina Project. Adviser: Dr. John George.

Ph.D. • **Massachusetts Institute of Technology**. Electrical Engineering. January, 2004. Center for Electromagnetic Theory and Applications (CETA) laboratory. Adviser: Professor Jin Au Kong. Thesis title: *Electromagnetic Scattering and Induction Models for Spheroidal Geometries*.

M.S. • **Brigham Young University**. Electrical Engineering. June, 1999. Microwave Earth Remote Sensing (MERS) lab. Adviser: Professor David G. Long. Thesis title: *YSCAT Backscatter Distributions*

B.S. • **Brigham Young University**. Electrical Engineering. June, 1999.

Research Interests

- Electromagnetic models, Electromagnetic Induction (EMI), Fast electromagnetic solver methods.
- Electromagnetic Neuroscience. Neuronal recording, stimulation, and modeling methods.
- Rough surface scattering, Remote sensing, Sub-surface detection, numerical methods in EM.
- Superconducting Magnetic Energy Storage (SMES), Power generation and storage, Nanoscale electromagnetic interaction and phenomena, Human machine interaction.

Professional Experience

CRREL • **August 2005 to present.** Hanover, NH. Research Physicist. EMI induction; UXO remediation studies.

Los Alamos • **May 2004 to August 2005.** Los Alamos, NM. Director's Funded post-doctoral appointee. Biological and Quantum Physics, P-21. Researching and modeling artificial retinas. Neurophysiological stimulation techniques.

Hewlett-Packard • **June 1998 to August 1998.** Santa Rosa, CA. Internship. Test & Measurement Division. Microwave circuit designer. Researched YIG oscillator characteristics.

Seino Joho Service • **June 1996 to December 1996.** Internship in Japan, Gifu Prefecture, Gifu City. Implemented Internet based client/server product ordering system in JAVA.

Teaching Experience

Teaching Assistant • Massachusetts Institute of Technology. 6.013 - Electromagnetics and Applications, Lecturer - Professor Erich Ippen. Spring 2003.

IAP Instructor • MIT Independent Activities Period Class. Computer Numerical Control (CNC) Lathe demonstration. Volunteer. Jan., 2004.

Math Tutor • Brigham Young University. Up to and including calculus, 3 years.

Volunteer • Volunteer teaching missionary in Tokyo, Japan, 1993-4.

Math TA • Volunteer calculus TA. Cottonwood High School. 1990.

Awards

Appointment • Director's Funded post-doctoral appointee. Los Alamos National Laboratory.

Fellowship • National Science Foundation Graduate Fellowship. 1999-2002.

Scholarship • Trustee's Scholarship recipient. Brigham Young University. Full tuition 1995-1999.

Awards (continued)

Grant	• Rocky Mountain Space Grant Consortium. 1997-8 and 1998-9 school years.
Award	• Sterling Scholar. Named top Mathematics High School student in Utah, 1991.

Professional Activities

- Member IEEE.
- Member Eta Kappa Nu, Brigham Young University.
- Progress in Electromagnetics Research Symposium (PIERS), 2002 technical committee member.

Publications

Journal Papers

- Tomasz M. Grzegorczyk, Beijia Zhang, Jin Au Kong, Benjamin E. Barrowes, and Kevin O'Neill. "Electromagnetic induction from highly permeable and conductive ellipsoids under arbitrary excitation - application to the detection of unexploded ordnances." IEEE Trans. on Geoscience and Remote Sensing, accepted for publication.
- F. Shubitidze, K. O'Neill, B. E. Barrowes, J. P. Fernndez, I. Shamatava, K. Sun, and K.D. Paulsen, "Application of the normalized surface magnetic charge model to UXO discrimination in cases with overlapping signals," Journal of Applied Geophysics, 61(3-4):292–303, 2007.
- Barrowes B. E., O'Neill K., Grzegorczyk T., Chen X., and Kong J. A., "Broadband Electromagnetic Induction Solution for a Conducting and Permeable Spheroid," Transactions on Geoscience & Remote Sensing, Nov. 2004, vol.42, no.11, p.2479-89.
- Barrowes B. E., O'Neill K., Grzegorczyk T., and Kong J. A., "Asymptotic Expansions of the Prolate Spheroidal Wave Function and Their Eigenvalues for Complex Size Parameter," Studies in Applied Mathematics, Oct. 2004, v.113, no.3, p.271-301.
- Barrowes B. E., Ao C. O., Teixeira F. L., and Kong J. A., "Sparse matrix/canonical grid method applied to 3-D dense medium simulations," Oct. 2002, IEEE Trans. on Antennas and Propagation.
- Barrowes, B. E., and Long, D. G., "Evaluation of a compound probability model with tower-mounted scatterometer data," IEEE Trans. on Geo. and Remote Sensing, Jan. 2002, vol. 40(1), pp 42-9.
- Barrowes B. E., Teixeira F. L., and Kong J. A., "Fast Algorithm for Matrix-Vector Multiply of Asymmetric Multilevel Block-Toeplitz Matrices in 3-D Scattering," Microwave and Optical Technology Letters, October 2001, Wiley InterScience.
- Barrowes B. E., Ao C. O., Teixeira F. L., Kong J. A., and Tsang, L., "Monte Carlo Simulation of Electromagnetic Wave Propagation in Dense Random Media with Dielectric Spheroids," The Institute for Elect., Inf., and Comm. Engineers, Vol. E83-C, No. 12, Dec. 2000.
- Chen X., O'Neill K., Barrowes B. E., Grzegorczyk T. M., and Kong J. A., "Application of a spheroidal mode approach and a differential evolution algorithm in the inversion of magneto-quasistatic data for UXO discrimination," Inverse Problems, Sep. 2004, vol. 20, pp 27-40.
- Yao X-C., Foust A., Rector D. M., Barrowes B. E., and George J. S., "Cross-polarized reflected light measurement of fast optical responses associated with neural activation," Biophysical Journal, submitted for publication, Sep. 2004.

Conference Papers

- Irma Shamatava, B. Barrowes, F. Shubitidze, J. P. Fernandez, and K. O'Neill. Estimating soil's effective magnetic susceptibility from emi data. SPIE, 2007.
- F. Shubitidze, B. Barrowes, J. P. Fernandez, Irma Shamatava, and K. O'Neill. A combined nsmc and pole series expansion approach for uxo discrimination. SPIE, 2007.
- F. Shubitidze, B. Barrowes, J. P. Fernandez, Irma Shamatava, and K. O'Neill. Nsmc for uxo discrimination in cases with overlapping signatures. SPIE, 2007.
- J. P. Fernandez, Keli Sun, B. Barrowes, K. O'Neill, Irma Shamatava, and F. Shubitidze. Inferring the location of buried uxo using a support vector machine. SPIE, 2007.
- F. Shubitidze, B. Barrowes, J. P. Fernandez, and K. O'Neill. Combined nsmc and pseudo-spectral finite-difference method for inverting a buried object location. Symposium on the Application of Geophysics to Engineering and Environmental Problems, 2007.

Publications (continued)

- F. Shubitidze, D. Karkashadze, B. Barrowes, and K. O'Neill. An analytical expression for estimating a buried object's location, orientation and magnetic polarization to support UXO discrimination. XIIth International Seminar/Workshop on Direct and Inverse Problems of Electromagnetic and Acoustic Wave Theory (DIPED), 2007.
- F. Shubitidze, B. E. Barrowes, , K. O'Neill, I. Shamatava, J. P. Fernández, K. Sun, and K.D. Paulsen, "The generalized SEA to UXO discrimination in geophysical environments producing EMI response," SPIE Security and Defense Conference, Orlando, FL, April 2006.
- I. Shamatava, B. E. Barrowes, F. Shubitidze, K. O'Neill, J. P. Fernández, K. Sun, and P.D. Paulsen, "Investigation of EMI response for magnetically susceptible rough surfaces," SPIE Security and Defense Conference, Orlando, FL, April 2006.
- K. Sun, K'Neill, B. E. Barrowes, J. P. Fernández, F. Shubitidze, I. Shamatava, K. D. Paulsen, "Dumbbell dipole model and its application in UXO discrimination," SPIE Security and Defense Conference, Orlando, FL, April 2006.
- Juan Pablo Fernádez, Benjamin Barrowes, Kevin O'Neill, Keith Paulsen, Irma Shamatava, Fridon Shubitidze, and Keli Sun, "Evaluation of SVM classification of metallic objects based on a magnetic-dipole representation," SPIE Security and Defense Conference, Orlando, FL, April 2006.
- Barrowes B. E., Kevin O'Neill, Tomasz M. Grzegorczyk, and J. A. Kong, "Asymptotic Expansions of the Prolate Angular Spheroidal Wave Function for Complex Size Parameter," Progress in Electromagnetics Research Symposium (PIERS), October 2003.
- Barrowes B. E., Kevin O'Neill, Tomasz M. Grzegorczyk, and J. A. Kong, "Broadband, Analytic Electromagnetic Induction (EMI) Response from Spheroidal Objects for Arbitrary Excitation," Progress in Electromagnetics Research Symposium (PIERS), October 2003.
- Barrowes B. E., Teixeira F. L., and Kong J. A., "Electromagnetic Induction (EMI) Response from Conducting and Permeable Spheroidal Shells," Progress in Electromagnetics Research Symposium (PIERS), July 2002.
- Barrowes B. E., Teixeira F. L., and Kong J. A., "Fast Algorithm for Matrix-Vector Multiply of Asymmetric Multilevel Block-Toeplitz Matrices," IEEE Ant. and Prop. Symp., July 2001.
- Barrowes B. E., "Characterizing Dense Distributions of Spheroidal Particles in Random Media," Progress in Electromagnetics Research Symposium (PIERS), July 2000.
- Long, D. G., Barrowes, B. E., and Arnold, D. V., "Radar cross section dependence on wind speed," IEEE 1999 International Geoscience and Remote Sensing Symposium, 1999, pp 1863-5, vol. 3.

Other

- Barrowes B. E., "Electromagnetic Scattering and Induction Models for Spheroidal Geometries," Ph.D. Thesis, Massachusetts Institute of Technology, Cambridge Massachusetts, Feb. 2004.
- Barrowes B. E., "YSCAT Backscatter Distributions," Master's Thesis, Brigham Young University, Provo Utah, June 1999.
- Barrowes B. E., "matlab2fmex.m," Matlab™ to Fortran90 MEX-file translator, Open source project, https://sourceforge.net/projects/matlab2fmex/
- Barrowes B. E., "f2matlab.m," Fortran90 to Matlab™ translator, Open source project, https://sourceforge.net/projects/f2matlab/
- Barrowes B. E., "Computation of Special Functions," Translated (using f2matlab) Fortran code by S. Zhang and J. Jin to Matlab™ . Code posted at: http://ceta.mit.edu/comp_spec_func/index.html
- Barrowes B. E., "Vectorized Module for MPFUN," Wrote routines to allow MPFUN, an arbitrary precision mathematical package written in FORTRAN90, to accomodate vectorized statements. Part of MPFUN: http://crd.lbl.gov/∼dhbailey/mpdist/
- Barrowes B. E., "Mathematica Symbolic Toolbox for MATLAB," Updated Matlab toolbox which allows access to Mathematical kernel from Matlab. http://library.wolfram.com/infocenter/MathSource/5344/
- Barrowes B. E., "The Multiple Precision Toolbox for Matlab," Toolbox which allows multiple precision arithmetic in Matlab via a library of mex interfaces to the GNU Multiple Precision Arithmetic Library and The MPFR Library. https://sourceforge.net/projects/mptoolbox/

Other

Computers	• UNIX, Linux, Windows, Matlab, Mathematica, Maple, Fortran, C, Java, AutoCAD, LaTeX, repair.
Languages	• English (native), Japanese
Family	• Pictures and information at http://alum.mit.edu/www/barrowes
Personal interests	• Woodworking, metalworking, church service, mechanic, soccer, volleyball, camping.