Gregory T. Ely

Education

Massachusetts Institute of Technology **2013 September - Present**

Doctor of Philosophy, Geophysics.
Area of research: Exploration seismology

Tufts University **2010 - 2013**

Master of Science, Electrical Engineering.
Thesis: Reduced Complexity Regularization of Geophysical Inverse Problems.

Carleton College **2004 - 2008**

Bachelor of Arts, *Magna cum Laude* with Distinction in Physics.
Received Distinction for Senior Thesis: The Physics of Traffic and Crowds

Fellowships

Statoil-MIT Energy Graduate Fellowship **2014**

Praecis Presidential Graduate Fellowship **2013**

National Science Foundation Graduate Fellowship Program **2012 -2016**

Research Experience

Massachusetts Institute of Technology **2013 September - present**

Research Assistant
Geophysics department, Alison Malcolm, Advisor. Exploring boundary integral methods for fast wave simulation and reduced model space. I am combining these fast forward solvers with particle swarm optimization to globally estimate initial velocity models and provide error estimates on inversions.

Tufts University **2010 May - 2013 August**

Research Assistant
Electrical Engineering department, Shuchin Aeron, Advisor. Examined the application of complexity penalized algorithms to solve a variety of geophysical inverse problems: hydraulic fracture monitoring, hyperspectral imaging, and reflection seismology. Demonstrated how the physics of several systems give rise to sparsity or low-dimensionality when posed in the proper basis and can be exploited to improve inversion.

Schlumberger Doll Research **2012 & 2015 Summer**

Intern
Math & Modeling Department, Sandip Bose, Supervisor. Developed new algorithms for cement evaluation in boreholes using an ultrasonic transducer to image through the borehole casing. Created a new technique that improves the detection and characterization of the bond between cement and the rock formation.

MIT Lincoln Laboratory **2008 September - 2012 January**

Researcher

Tactical Defense Systems, Kevin Cohen, Supervisor. Developed a modular real time radar tracker in C++ to run on multiple ground based radar systems. Wrote and debugged real time imagery and data recording systems in C and C++. Developed MATLAB image processing and tracking tools to perform analyses of infrared imagery. Designed tests of infrared optical systems. Simulated and modeled the performance of optical systems, the atmosphere, and radiation of the viewed images.

Carleton College **2007 January - 2008 June**

Research Assistant

LIGO (Laser Interferometer Gravitational Wave Observatory) Scientific Collaboration, Nelson Christensen, Supervisor. Developed and debugged MATLAB programs which analyzed environmental sensor data to diagnose sources of continuous noise in gravitational wave detectors. Wrote and optimized code to run efficiently on distributed grid computers to assess the quality of analyzed sensor and interferometer data.

Boston University **2006 Summer**

Research Assistant

Research Assistant, Hearing Research Center, Department of Biomedical Engineering, Boston University. Steven Colburn, Director. Wrote and debugged code modules in C++ for EarLab, a program used to simulate components of the human auditory system. Developed a multi-platform Java graphical user interface to run EarLab simulations.

Teaching Experience

Carleton College

Teaching Assistant **2007 - 2008 Academic year**

Teaching Assistant. Graded homework for Thermodynamics (Professor A. K. Pattanayak). Tutored for Relativity and Particles (Professor S. Parker).

Rock Climbing Instructor **2005 - 2008 Academic year**

Rock climbing instructor; Recreational Center, Carleton College. Supervised and instructed students in rock climbing.

Skills

- Programming Languages: C++, Java, C, Python, MATLAB, HTML/CSS, UNIX shell scripting
- Computational Tools: Mathematica, Seismic Unix, Pysit, LaTeX, CVS, Subversion, Git

Graduate Research

Journal Publications

"5D seismic data completion and de-noising using a novel class of tensor decompositions", Gregory Ely, Shuchin Aeron, Ning Hao, and Misha E. Kilmer; Geophysics, Vol 80,. No 4, 2015

"Exploiting algebraic and structural complexity for single snapshot computed tomography hyperspectral imaging systems", Bo Fan, Gregory Ely, Shuchin Aeron, and Eric Miller; IEEE Journal on Selected Topics in Signal Processing: Special issue on Advances in Hyperspectral Data Processing and Analysis, 2015

Conference Proceedings

"Combining global optimization and boundary integral methods to robustly estimate subsurface velocity models", Gregory Ely, Alison Malcolm, and David Nicholls; October 2015 SEG Annual meeting, New Orleans, Louisiana

"Novel factorization strategies for higher order tensors: Implications for compression and recovery of multilinear data", Zemin Zhang, Gregory Ely, Shuchin Aeron, Ning Hao and Misha Kilmer; Computer Vision and Pattern Recognition, June 2014, Columbus, Ohio; Oral Presentation & Paperl; Oral Presentation Acceptance Rate 5.75%

"Methods for Large Scale Hydraulic Fracture Monitoring" Gregory Ely and Shuchin Aeron; 2013 December IEEE CAMSAP, Saint Martin, French West Indies, France

"5D and 4D pre-stack seismic data completion using tensor nuclear norm (TNN)" Gregory Ely, Shuchin Aeron, Ning Hao, and Misha E. Kilmer; 2013 September SEG Annual Meeting, Houston, Texas

"Complexity Penalized Hydraulic Fracture Localization and Moment Tensor Estimation Under Limited Model Information" Gregory Ely and Shuchin Aeron; 2013 June, International Congress on Acoustics, Montreal, Canada

"Exploiting Structural Complexity For Robust and Rapid Hyperspectral Imaging" Gregory Ely, Shuchin Aeron, and Eric Miller; 2013 May IEEE ICASSP, Vancover, Canada

"Robust Hydraulic Fracture Monitoring (HFM) of multiple time overlapping events using a generalized discrete radon transform" Gregory Ely and Shuchin Aeron; 2012 July, IEEE IGARSS Symposium, Munich, Germany

Presentations

"Combining Global Optimization and Boundary Integral Methods to Robustly Estimate Seismic Velocity Models", Gregory Ely, Alison Malcolm, and David Nicholls; SIAM Conference on Mathematical and Computational Issues in the Geosciences 2015, Poster presentation

"Separation of continuous GPS transients using independent component analysis and low rank methods", Gregory Ely and Tom Herring; American Geophysical Union Fall 2014 meeting, Oral presentation

"Compressibility of 5D Seismic Data Under Various Tensor Decompositions", Shuchin Aeron and Gregory Ely; SEG 2015 New Orleans Post Convention Workshop, Oral presentation

Undergraduate Publications

"Search for gravitational waves from binary black hole inspiral, merger and ringdown" B. J. Abadie *et al.* (LIGO Scientific Collaboration & Virgo Collaboration),Phys. Rev. D 83, 122005 (2011).

"Search for Gravitational Waves from Compact Binary Coalescence in LIGO and Virgo Data from S5 and VSR1" B. J. Abadie *et al.* (LIGO Scientific Collaboration & Virgo Collaboration), Phys. Rev. D 82, 102001 (2010)

"Search for gravitational waves from low mass compact binary coalescence in 186 days of LIGO's fifth science run" B. Abbott *et al.* (LIGO Scientific Collaboration), Phys. Rev. D 80 047101 (2009)

"An upper limit on the stochastic gravitational-wave background of cosmological origin" B. Abbott *et al.* (LIGO Scientific Collaboration & Virgo Collaboration), Nature, Vol. 460, p. 990 (2009)

"Einstein@Home search for periodic gravitational waves in early S5 LIGO data" B. Abbott *et al.* (LIGO Scientific Collaboration), Phys. Rev. D 80 042003 (2009)

"Search for gravitational waves from low mass binary coalescences in the first year of LIGO's S5 data" B. Abbott *et al.* (LIGO Scientific Collaboration), Phys. Rev. D 79 122001 (2009)

"All-Sky LIGO Search for Periodic Gravitational Waves in the Early Fifth-Science-Run Data" B. Abbott *et al.* (LIGO Scientific Collaboration), Physical Review Letters 102 111102 (2009)

"Einstein@Home search for periodic gravitational waves in LIGO S4 data" B. Abbott *et al.* (LIGO Scientific Collaboration), Phys. Rev. D 79 022001 (2009)

"The LSC glitch group: monitoring noise transients during the fifth LIGO science run" L. Blackburn, L. Cadonati, S. Caride, S. Caudill, S. Chatterji, N. Christensen, J. Dalrymple, S. Desai, A. Di Credico, G. Ely, J. Garofoli, L. Goggin, G. Gonzlez, R. Gouaty, C. Gray, A. Gretarsson, D. Hoak, T. Isogai, E. Katsavounidis, J. Kissel, S. Klimenko, R. A. Mercer, S. Mohapatra, S. Mukherjee, F. Raab, K. Riles, P. Saulson, R. Schofield, P. Shawhan, J. Slutsky, J. R. Smith, R. Stone, C. Vorvick, M. Zanolin, N. Zotov and J. Zweizig. Classical and Quantum Gravity, Vol. 25, 184004 (2008)