

## Michael Ham

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### CONTACT INFORMATION

Center for Nonlinear Studies  
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### RESEARCH INTERESTS

Complex systems, social networks, artificial intelligence, the development of functional network structures and connectivity patterns in living and artificial networks, creating meaningful interaction with neural networks using electrical stimulation, developing learning algorithms, data analysis, Bayesian analysis, and information theory.

### TECHNICAL SKILLS

- Software: Python, FORTRAN, PHP, MATLAB, Mathematica, Linux/UNIX, OS X, Windows XP and Vista.
- Hardware: Data Acquisition with National Instruments hardware and MATLAB software, electronic circuitry, machine shop tools.

### EDUCATION

**University of North Texas**, Denton, Texas

Ph.D. Physics.

- Thesis: *Analysis of spontaneous coordinated activity in cultured neural networks: Quantification of primary circuits, multiple ignition sites, and burst phase delay distributions*
- Thesis Advisers: Guenter W. Gross and Floyd D. McDaniel

B.A. Physics, December 2003

### HONORS AND AWARDS

- Best Poster in Neurophysiology. University of North Texas Graduate Research Day 2006
- Best Graduate Poster. University of North Texas Graduate Research Day 2005
- University of North Texas Department of Physics scholarship 1999
- Texas Academy of Mathematics and Science Summer Research Grant 1998
- Acceptance into the Texas Academy of Mathematics and Science 1997-1999
- United States Navy and Marine Corps Special Award and Department of the Army Certificate of Achievement for high school science fair project (1996)

### PUBLICATIONS

Bettencourt L. M. A., Gintautas V., and Ham M. I. Identification of functional information subgraphs in complex networks. *Physical Review Letters* 100:238701, 2008. <http://arxiv.org/abs/0712.2218>

Ham M. I., Bettencourt L. M. A., Gross G. W., McDaniel F. D. Spontaneous coordinated activity in cultured networks: Analysis of multiple ignition sites, primary circuits and burst phase delay distributions. *J. Comp. Neurosci.*, 2007.

Bettencourt L. M. A., Stephens G. Ham M. I., Gross G. W. Functional structure of cortical neuronal networks grown in vitro. *Phys. Rev. E.* 75(2):021915, 2007.

### PAPERS IN PREPARATION

Ham M. I., Rodriguez M. A. A Boundary Approximation Algorithm for Distributed Sensor Networks. *Submitted to Sensors arXiv:0901.3384v1.*

Ham M. I., Gintautas V., Rodriguez M. A., Bennett R. A., Santa Maria C. L., Bettencourt L. M. A. Density-dependence of functional development in spiking cortical networks grown in vitro. *Submitted to J. Comp. Neurosci. arXiv:0811.3584*

### INVITED TALKS

Density-dependence of functional development in spiking cortical networks grown in vitro. 2009 Dynamics Days, San Diego, California

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Identification of the structure and dynamics of collective activity in cultured neural networks. 2008 Indiana University, Bloomington, Indiana

CONFERENCE  
PRESENTATIONS

A Prospectus on the Obstacles Inhibiting the Implementation of Advanced Artificial Neural Systems - Part 1. 2009 Decade of the Mind, Albuquerque, New Mexico

On the relationship between neural density and functional connectivity in the murine cortex. 2009 Dynamics Days, San Diego, California

Origins of spontaneous network activity in vitro: primary circuits and burst leaders (poster). 2007 Society for Neuroscience annual meeting, San Diego, California.

Network population potentiation in response to high frequency stimulation (poster). 2007 Society for Neuroscience annual meeting, San Diego, California.

Comparison of stimulation efficacy in vitro using naturally and artificially generated patterns (poster). 2007 Grand Challenges in Neural Computation, Santa Fe, New Mexico.

Exploring internal network dynamics with burst phase delay distributions (poster). 2006 World Association of Modeling second annual Biologically Accurate Modeling Meeting, San Antonio, Texas.

Connectivity, synergy and stimulus encoding in cultured neural networks (poster). 2005 Society for Neuroscience annual meeting, Washington D.C.

RESEARCH  
EXPERIENCE

**Los Alamos National Laboratory**, Los Alamos, New Mexico  
*Center for Nonlinear Studies and P-21*,

*Postdoctoral Research Assistant*, Fall 2008 - present

Creating models of the mammalian visual system on a peta-scale computer. Performing experiments on retinal tissue for the NSF artificial retina project.

**Los Alamos National Laboratory**, Los Alamos, New Mexico  
*T-7, Theoretical Division and the Center for Nonlinear Studies (CNLS)*,

*Visiting Graduate Student*, Summer 2007 - Fall 2008

Studying connectivity, hierarchy and learning in mature and developing *in vitro* neuronal networks using Bayesian and information theoretic analysis methods, designing artificial predictive networks, creating stimulation paradigms for interacting with living neural networks.

**University of North Texas**, Denton, Texas  
*Center for Network Neuroscience (CNNS)*,  
Departments of Physics and Neuroscience

*Graduate Research Assistant*, August 2005 - September 2008

Studied previously dissociated *in vitro* neural networks growing on microelectrode arrays, designed and ran electrophysiology experiments, performed data analysis on experimental results, performed laboratory maintenance, interacted with multidisciplinary groups, started an ongoing Neuroscience & Physics department collaboration.

**Ion Beam Modification and Analysis Laboratory (IBMAL)**,  
Department of Physics

*Undergraduate and Graduate Research Assistant*, June 2003 - August 2005

Assembled beam lines, fabricated custom components using machine shop tools, learned to operate the 2.5 MV Van de Graaf accelerator, worked on modifying carbon nanotubes for efficient Hydrogen absorption.

**COOL N<sub>2</sub> CAR Laboratory**  
Departments of Engineering and Physics

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*Undergraduate Research Assistant*, March 1998 - June 2003

Performed experiments to improve the efficiency of a liquid nitrogen power train, assisted in the research, design, and fabrication of a next generation double acting liquid nitrogen power train, hold the unofficial land speed record for a liquid nitrogen powered vehicle, presented the COOL N2 CAR at numerous events including the Canadian International Auto Show in Toronto, Canada, designed and fabricated an air-powered bicycle and double acting drive train as a prototype for the car.

TEACHING  
EXPERIENCES

**University of North Texas**, Denton, Texas  
Department of Physics

*Teaching Assistant*, January 2004 - August 2005

Physics Instruction Center. Led up to four laboratory sections per week. Oversaw students performing experiments, presented material to students, and assisted students with solving assigned problems.

- 1210 Physics for Education Majors (Lab), Spring 2004 - Summer 2004.
- 1430 Non-Calculus based Physics (Lab), Spring 2004 - Summer 2004.
- 1730 Introduction to Mechanics (Lab), Fall 2004 - Summer 2005.
- 2240 Introduction to Electricity and Magnetism (Lab), Fall 2004 - Summer 2005.

*Teaching Assistant*, Spring 2003 - Summer 2003

Outdoor Astronomy Laboratory. Led up to 4 sections per week. Was responsible for opening the laboratory, managing the laboratory assistants, presenting the material to students, performing minor repairs on telescopes, and entering grades.

- 1061 Stellar Systems Observation Laboratory (Lab), Spring 2003 - Summer 2003

MEMBERSHIPS

- Toastmasters International, 2007 - present, Vice President of Public Relations
- American Physical Society, 2007 - present

References as well as copies of publications and papers in preparation are available upon request.