Nicholas Timme

Curriculum Vitae

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Positions

2016 - Present **Post-Doctoral Researcher**, *Indiana University - Purdue University Indianapolis.*
Advisor: Chris Lapish

Education

2009 - 2015 **Ph.D.**, *Indiana University*, Physics.

2008 - 2009 **M.S.**, *Indiana University*, Physics.

2004 - 2008 **B.A.**, *Illinois Wesleyan University*, Physics & Philosophy, Summa cum laude.

Honors & Awards

2015 **Travel Award**, *Indiana University College of Arts and Sciences*, $500.
Awarded to support graduate student travel to conferences.

2015 **Traveling Scholar Award**, *Conference on Complex Systems 2015*, $350.
Awarded to support graduate student travel to the conference.

2015 **William Koss Memorial Award**, *Indiana University Physics Department*, $2,500.
Awarded to the most outstanding graduate student in physics.

2015 **Shirley Chan Student Travel Award**, *APS March Meeting 2015*, $400.
Declined due to an unforeseen family obligation.

2013 **Poster Award**, *Society for Neuroscience Indianapolis Chapter Meeting*, $100, 2nd Place.

2013 **John H. Edwards Fellowship**, *Indiana University College of Arts and Sciences*, $20,000.
Awarded to support graduate students in the College of Arts and Sciences based on outstanding academic performance, research, and character.

2012 **Mabel La Duke Lauder Award**, *Indiana University College of Arts and Sciences*, $2,500.
Awarded to support novel research in science.

2009 **Graduate Assistantships in Areas of National Need Recipient (Teaching)**, *Indiana University Physics Department*, $28,000.
Awarded to support Physics Department associate instructors.

2008 **Phi Kappa Phi Fellowship**, *Phi Kappa Phi Honor Society*, $5,000.
Awarded to support future graduate or professional school students.

2008 **Phi Kappa Phi Commencement Award**, *Illinois Wesleyan University*, $2,500.
Awarded by faculty members based on expected performance in graduate school.

2008 **Honors Thesis in Physics**, *Illinois Wesleyan University*.
The Vibrational Behavior of a Cured Carbon Fiber Plate and a Tennis Racket

2008 **Honors Thesis in Philosophy**, *Illinois Wesleyan University*.
Physicalism and Phenomenal Experience: An Investigation of Phenomenal Experience Using the Mereological Structure of Events

2004 - 2008 **Dean's List**, *Illinois Wesleyan University*.
Awarded based on semester GPA.

Publications

N. M. Timme*, N. Marshall*, N. Bennett, M. Ripp, E. Lautzenhiser, and J. M. Beggs, *Criticality maximizes complexity in neural tissue*, Frontiers in Physiology, 7 (425): 2016. doi: 10.3389/fphys.2016.00425.

* These authors contributed equally to this work.

N. Marshall*, N. M. Timme*, N. Bennett, M. Ripp, E. Lautzenhiser, and J. M. Beggs, *Analysis of power laws, shape collapses, and neural complexity: new techniques and MATLAB support via the NCC toolbox*, Frontiers in Physiology, 7 (250): 2016. doi: 10.3389/fphys.2016.00250.

* These authors contributed equally to this work.

N. M. Timme, S. Ito, M. Myroshnychenko, S. Nigam, M. Shimono, F. C. Yeh, P. Hottowy, A. M. Litke, and J. M. Beggs, *High-degree neurons feed cortical computations*, PLoS Computational Biology, 12 (5): 2016. e1004858. doi: 10.1371/journal.pcbi.1004858.

S. Nigam, M. Shimono, S. Ito, F. C. Yeh, N. Timme, M. Myroshnychenko, C. C. Lapish, Z. Tosi, P. Hottowy, W. C. Smith, S. C. Masmanidis, A. M. Litke, O. Sporns, and J. M. Beggs, *Rich-club organization in effective connectivity among cortical neurons*, Journal of Neuroscience, 36 (3): 2016. doi: 10.1523/JNEUROSCI.2177-15.2016.

N. Timme, S. Ito, M. Myroshnychenko, F. C. Yeh, E. Hiolski, P. Hottowy, and J. M. Beggs, *Multiplex networks of cortical and hippocampal neurons revealed at different timescales*, PLoS One, 9 (12): 2014. e115764. doi: 10.1371/journal.pone.0115764.

S. Ito, F. C. Yeh, E. Hiolski, P. Rydygier, D. Gunning, P. Hottowy, N. Timme, A. M. Litke, and J. M. Beggs, *Large-scale, high-resolution multielectrode-array recording depicts functional network differences of cortical and hippocampal cultures*, PLoS One, 9 (8): 2014. doi: 10.1371/journal.pone.0105324.

N. Timme, W. Alford, B. Flecker, and J. M. Beggs, *Synergy, redundancy, and multivariate information measures: an experimentalist's perspective*, Journal of Computational Neuroscience, 36 (2): 2014. doi: 10.1007/s10827-013-0458-4.

N. Timme, M. Baird, J. Bennett, L. Garrison, J. Fry, and A. Maltese, *A Summer Math and Physics Program for High School Students: Student Performance and Lessons Learned in the Second Year*, Physics Teacher, 51 (280): 2013. doi:10.1119/1.4801354.

J. M. Beggs and N. Timme, *Being critical of criticality in the brain*, Frontiers in Physiology, 3 (163): 2012. doi: 10.3389/fphys.2012.00163.

J. Bennett, J. Fry, N. Timme, and A. Maltese, *Lessons learned from a summer preparatory program on foundations in physics and calculus*, Journal of College Science Teaching, 41 (52): 2012.

N. Timme and A. Morrison, *The mode shapes of a tennis racket and the effects of vibration dampers on those mode shapes*, Journal of the Acoustical Society of America, 125 (6): 2009.

Presentations & Posters

Poster **N. Timme, D. N. Linsenbardt, M. Myroshnychenko, and C. C. Lapish**, *Improvements to information theory analysis techniques throughout neuroscience with MATLAB support*, Society for Neuroscience Annual Meeting, November 11th - 16th, 2016, San Diego, CA.

Presentation **N. Timme, S. Ito, M. Myroshnychenko, F. C. Yeh, P. Hottowy, A. Litke, J. M. Beggs**, *Hub neurons contribute more to computation*, Conference on Complex Systems, September 28th - October 2nd, 2015, Phoenix, AZ.

Poster **N. Timme, S. Ito, M. Myroshnychenko, F. C. Yeh, E. Hiolski, A. Litke, J. M. Beggs**, *High degree neurons tend to contribute more and process less information in cortical networks*, Cosyne, March 5th - 8th, 2015, Salt Lake City, UT.

Poster **N. Timme, S. Ito, M. Myroshnychenko, F. C. Yeh, E. Hiolski, A. Litke, J. M. Beggs**, *Synergy and redundancy in timescale dependent multiplex networks of hippocampal and cortical neurons*, APS March Meeting, March 2nd - 6th, 2015, San Antonio, TX.
Withdrawn due to an unforeseen family obligation

Invited Presentation **N. Timme**, *Time series analysis with transfer entropy*, IUPUI Mathematical Modeling and Computational Science Seminar, February 13th, 2015, Indianapolis, IN.

Poster **N. Timme, S. Ito, M. Myroshnychenko, F. C. Yeh, E. Hiolski, A. Litke, J. M. Beggs**, *Synergy and redundancy in timescale dependent multiplex networks of hippocampal neurons*, Society for Neuroscience Annual Meeting, November 15th - 19th, 2014, Washington, DC.

Poster **N. Timme, S. Ito, M. Myroshnychenko, F. C. Yeh, E. Hiolski, A. Litke, J. M. Beggs**, *Synergy and redundancy in timescale dependent multiplex networks of hippocampal neurons*, Society for Neuroscience Indianapolis Chapter Meeting, October 10th, 2014, Indianapolis, IN.

Poster **N. Timme, S. Ito, M. Myroshnychenko, F. C. Yeh, E. Hiolski, A. Litke, J. M. Beggs**, *Multiplex networks of cortical and hippocampal neurons revealed at different timescales*, Computational Neuroscience, July 26th - 31st, 2014, Québec City, Canada.

Poster **N. Timme, S. Ito, M. Myroshnychenko, F. C. Yeh, E. Hiolski, A. Litke, J. M. Beggs**, *Transfer entropy reveals time scale dependent networks and hubs in hippocampal and cortical cultures*, Society for Neuroscience Indianapolis Chapter Meeting, October 18th, 2013, Indianapolis, IN.
Award: 2nd Place

Invited Presentation **N. Timme**, *Vibration damping in a tennis racket*, 159th Meeting of the Acoustical Society of America, April 19th - 23rd, 2010, Baltimore, MD.
Declined

Shared Data Sets

N. M. Timme, N. Marshall, N. Bennett, M. Ripp, E. Lautzenhiser, and J. M. Beggs, *Spontaneous spiking activity of thousands of neurons in rat hippocampal dissociated cultures*, CRCNS.org: 2016. doi: 10.6080/K0PC308P.

S. Ito, F. C. Yeh, N. M. Timme, P. Hottowy, A. M. Litke, and J. M. Beggs, *Spontaneous spiking activity of hundreds of neurons in mouse somatosensory cortex slice cultures recorded using a dense 512 electrode array*, CRCNS.org: 2016. doi: 10.6080/K07D2S2F.

Grants

2016 - Present **NIH T32: Training Grant on Genetic Aspects of Alcoholism (AA007462)**, Dr. Christine Czachowski (Principle Investigator), Dr. Christopher Lapish (Supervisor).

Research

2016 - Present **Post-Doctoral Research in Neuroscience**, *Indiana University - Purdue University Indianapolis*.
I work with Dr. Christopher Lapish at Indiana University - Purdue University Indianapolis. We study information encoding and computations performed at the cellular level in awake behaving rodents, primarily in relation to alcoholism. Specifically, we are interested in how groups of neurons work together to encode, transmit, and compute information in prefrontal cortex and other non-cortical structures.

2009 - 2015 **Graduate Research in Biophysics**, *Indiana University*.
I worked with Dr. John Beggs at Indiana University. We studied the behavior of organic neural networks. Specifically, we were interested in questions regarding how information is represented and transformed in neural networks. In addition, we studied the role criticality plays in the functions of neural networks.

2007 - 2008 **Undergraduate Research in Acoustics**, *Illinois Wesleyan University*.
I worked with Dr. Andrew Morrison to study the vibrational behavior of carbon fiber plates and a tennis racket. I completed my honors thesis in physics as part of this research.

2007 **Research Experience for Undergraduates (REU) Participant**, *Kansas State University*.
I worked with Dr. Itzik Ben-Itzhak to study laser-ion interactions.

2006 - 2007 **Undergraduate Research in Philosophy of Mind**, *Illinois Wesleyan University*.
I worked with Dr. Leonard Clapp to study issues related to phenomenal experience. I completed my honors thesis in philosophy as part of this research.

2006 **Undergraduate Research in Astronomy**, *Illinois Wesleyan University*.
I worked with Dr. Linda French to perform comet and asteroid data analysis.

2005 **Undergraduate Research in Optical Physics**, *Illinois Wesleyan University*.
I worked with Dr. Gabe Spalding on an optical tweezer system.

2005 **Undergraduate Research in Optical Physics**, *Illinois Wesleyan University*.
I worked with Dr. William Brandon to study magneto-optics.

Skills

Computer	MATLAB, Microsoft Office, LaTeX, Unix, Mathematica, C
Culturing	Production and maintanence of dissociated neural cultures
Electrophysiology	Recording using a Multichannel array system
Data Analysis	Information Theory, Network Analysis, Functional Connectivity, Effective Connectivity, Spike Sorting, Critical Systems, Neural Avalanches, Statistics

Education Outreach

2010 - 2014 **Foundations in Science and Mathematics**.
Along with fellow Indiana University Physics graduate students Jake Bennett, Jason Fry, and Lance Garrison, I created a summer program for high school students in Bloomington, Indiana to help them prepare for their upcoming high school math and physics courses. We have had more than 350 participants over five summers. The program continued following our graduation.

- Program Website: http://www.indiana.edu/~fsm/
- Grants Obtained: Indiana Space Consortium (2011: $2,600; 2012: $9,600; 2013: $5,000; 2014: $5,000)

2011 - 2014 **WonderLab Museum of Health, Science, and Technology**.
Along with faculty from Indiana University, WonderLab employees, and an Indiana University Computer Science graduate student, I worked to create an interactive brain wave exhibit for children.

Teaching Experience

Physics I Discussion, *Non-Calculus*, P201, 9 Sections.
- Summer 2009: Dr. Challifour
- Spring 2010: Dr. Carini, Dr. Musser
- Fall 2015: Dr. Beggs, Dr. Fertig

Physics I Laboratory, *Non-Calculus*, P201, 4 Sections.
- Fall 2008: Dr. Pynn, Dr. Lee
- Summer 2014: Dr. Challifour

Physics I Discussion, *Calculus*, P221, 5 Sections.
- Fall 2011: Dr. Lunghi
- Fall 2012: Dr. Lunghi

Physics I Laboratory, *Calculus*, P221, 2 Sections.
- Spring 2015: Dr. Snow

Physics II Discussion, *Non-Calculus*, P202, 2 Sections.
- Summer 2015: Dr. Bossev

Physics II Laboratory, *Non-Calculus*, P202, 4 Sections.
- Spring 2009: Dr. Long
- Fall 2014: Dr. Lammers, Dr. Pynn

Physics II Discussion, *Calculus*, P222, 2 Sections.
- Spring 2012: Dr. Warren

Physics II Laboratory, *Calculus*, P222, 2 Sections.
- Fall 2009: Dr. Urheim

Physics in the Modern World Grading, P101, 1 Section.
- Spring 2010: Dr. Lammers

Tutoring.
- Physics Tutor: 5 Years
- Math Tutor: 0.5 Years
- Philosophy Tutor: 1 Year
- Logic Tutor: 1 Year

Honor Societies

Phi Kappa Phi.

Phi Beta Kappa.

Phi Sigma Tau, *Philosophy Honor Society*.
Illinois Wesleyan University Chapter President Fall 2005 to Spring 2008

Pi Mu Epsilon, *Mathematics Honor Society*.

Alpha Lambda Delta, *Freshman Honor Society*.
Executive Board Member

Phi Eta Sigma, *Freshman Honor Society*.

Graduate School Assistantships & Fellowships

Fall 2008 - Spr. 2010 **Teaching Assistantship**.
I taught laboratory and discussion sections in physics

Fall 2010 - Spr. 2011 **Research Assistantship**.
I created physics exercises for the CALM online homework system (supporting faculty: Dr. de Souza (IU Chemistry))

Fall 2011 - Fall 2012 **Teaching Assistantship**.
I taught discussion sections in physics

Spr. 2013 - Sum. 2013 **Research Assistantship**.
I researched the relationship between proposed metrics of consciousness and critical phenomena in neural systems (supporting faculty: Dr. Beggs)

Fall 2013 - Spr. 2014 **John H. Edwards Fellowship**.
Awarded by Indiana University to support graduate students in the College of Arts and Sciences based on outstanding academic performance, research, and character.

Sum. 2014 - Fall 2015 **Teaching Assistantship**.
I taught laboratory and discussion sections in physics

Graduate Courses (Indiana University)

Electricity and Magnetism 1 & 2, *P506 & P507.*

Quantum Mechanics 1 & 2, *P511 & P512.*

Classical Mechanics, *P521.*

Statistical Physics, *P556.*

Introduction to Biophysics, *P575.*

Signal Processing, *P583.*

Biological and Artificial Neural Networks, *P582.*

Quantum Field Theory 1 & 2, *P621 & P622.*

Frontier Particle Physics 1, *P635.*

Topical Seminar in Science Education, *Educ-Q612.*