

# Nicholas M. Timme

*Curriculum Vitae*

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## Positions

- 2021 – Present **Assistant Research Professor:** Indiana University – Purdue University Indianapolis  
Advisor: Christopher Lapish
- 2016 – 2021 **Post-Doctoral Researcher:** Indiana University – Purdue University Indianapolis  
Advisor: Christopher 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

## Grants

- 2021 - 2026 **NIH K99/R00: Identifying how alcohol-evoked changes in neural firing affect systems level computations during decision-making (AA028265)**, Dr. Nicholas Timme (Principal Investigator), Dr. Christopher Lapish (Mentor).
- 2016 - 2018 **NIH T32: Training Grant on Genetic Aspects of Alcoholism (AA007462)**, Dr. Cristine Czachowski (Principal Investigator), Dr. Christopher Lapish (Supervisor).

## Publications<sup>†</sup>

- 2021 **N. M. Timme**, B. Ma, D. Linsenbardt, E. Cornwell, T. Galbari, and C. C. Lapish, Compulsive drinking is associated with neural activity patterns reflecting diminished behavioral control and enhanced seeking representations in dorsal medial prefrontal cortex, bioRxiv: 2021.03.15.435169. doi: 10.1101/2021.03.15.435169. Citations: 0.
- 2020 **N. M. Timme**, D. Linsenbardt, and C. C. Lapish, A method to present and analyze ensembles of information sources, Entropy 22 (5): 2020. doi: 10.3390/e22050580. Citations: 0.
- 2020 **N. M. Timme**, D. Linsenbardt, M. Timm, T. Galbari, E. Cornwell, and C. C. Lapish, Alcohol preferring P rats exhibit aversion resistant drinking of alcohol adulterated with quinine, Alcohol 83: 2020. doi: 10.1016/j.alcohol.2019.09.003. Citations: 6.
- 2020 S. P. Faber, **N. M. Timme**, J. M. Beggs, and E. L. Newman, Synergistic neural computation is greater downstream of recurrent connectivity in organotypic cortical cultures, bioRxiv: 2020.05.12.091215. doi: 10.1101/2020.05.12.091215. Citations: 0.
- 2019 S. P. Faber, **N. M. Timme**, J. M. Beggs, and E. L. Newman, Correlated activity favors synergistic processing in local cortical networks at synaptically-relevant timescales, Network Neuroscience 4 (3): 2019. doi: 10.1162/netn\_a\_00141. Citations: 2.
- 2019 D. N. Linsenbardt, **N. M. Timme**, and C. C. Lapish, Encoding of the intent to drink alcohol by the prefrontal cortex is blunted in rats with a family history of excessive drinking, eNeuro 6 (4): 2019. doi: 10.1523/ENEURO.0489-18.2019. Citations: 3.
- 2018 S. P. Faber, **N. M. Timme**, J. M. Beggs, and E. L. Newman, Computation is concentrated in rich clubs of local cortical networks, Network Neuroscience 3 (2): 2018. doi: 10.1162/netn\_a\_00069. Citations: 17.

- 2018 **N. M. Timme** and C. C. Lapish, [A tutorial for information theory in neuroscience](#), *eNeuro*, 5 (3): 2018. doi: 10.1523/ENEURO.0052-18.2018. Citations: 47.
- 2018 S. S. Janetsian-Fritz, **N. M. Timme**, A. M. McCane, A. J. Baucum II, B. F. O'Donnell, and C. C. Lapish, [Maternal deprivation induces alterations in cognitive and cortical function in adulthood](#), *Translational Psychiatry*, 8 (1): 2018. doi: 10.1038/s41398-018-0119-5. Citations: 12.
- 2016 **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. Citations: 44. \* These authors contributed equally to this work.
- 2016 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. Citations: 51. \* These authors contributed equally to this work.
- 2016 **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. Citations: 64.
- 2016 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. Citations: 108.
- 2014 **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. Citations: 34.
- 2014 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. Citations: 45.
- 2014 **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. Citations: 144.
- 2013 **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. Citations: 8.
- 2012 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. Citations: 379.
- 2012 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. Citations: 2.
- 2009 **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. Citations: 7.

† Total Citations: 973. Citation counts provided by Google Scholar as of April 2021.

## Shared Data Sets

- 2016 **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.
- 2016 **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.

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## Service

- 2020 - Present Volunteer Contributor to the Research Society on Alcoholism's Diversity Committee
- 2018 - Present Member of the Research Society on Alcoholism's Animals in Research Committee

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## Skills

- Computer MATLAB, Microsoft Office, LaTeX, Unix, C, Prism
- Electrophysiology Awake-behaving rodent, multi-electrode array cell culture
- Cell Culturing Production and maintenance of dissociated neural cultures
- Animal Behavior Handling, training, and performing experimental tasks using rats. General addiction neuroscience.
- Data Analysis Information Theory, Network Analysis, Functional Connectivity, Effective Connectivity, Spike Sorting, Critical Systems, Neural Avalanches, Statistics

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## 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 alcohol use disorder. 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.

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## Honors & Awards

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

- 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. All semesters. Awarded based on semester GPA.

## Travel & Conference Awards

- 2021 **Poster Award**, Society for Neuroscience Greater Indiana Chapter Meeting, 1<sup>st</sup> Place, Postdoc Category.
- 2019 **Junior Investigator Travel Award**, Research Society on Alcoholism, \$400. Awarded to support postdoc travel to the annual RSA conference
- 2018 **Junior Investigator Travel Award**, Research Society on Alcoholism, \$400. Awarded to support postdoc travel to the annual RSA conference
- 2017 **PLOS Early Career Travel Award**, PLOS, \$500. Awarded to support opportunities for early career researchers to present their work and participate in the scientific dialogue at a conference.
- 2017 **Junior Investigator Travel Award**, Research Society on Alcoholism, \$300. Awarded to support postdoc travel to the annual RSA conference.
- 2017 **Travel Award**, Statistical Analysis of Neuronal Data Workshop, \$600. Awarded to support postdoc travel to the Sand8 workshop.
- 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 **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, 2<sup>nd</sup> Place.

## Presentations

- 2021 **N. M. Timme**, Dorsal medial prefrontal cortex neural firing correlates of compulsive drinking in alcohol preferring P rats, Cambridge NeuroTech Webinar, April 14<sup>th</sup>. Invited.
- 2021 **N. M. Timme**, Examining compulsive drinking in a rodent model of alcohol use disorder, Oxford Science Café (University of Mississippi Physics Dept.), February 16<sup>th</sup>. Invited talk.

- 2019 **N. M. Timme**, Using information theory and modeling to unravel the decision to drink in alcohol use disorder, Society for the Quantitative Analysis of Behavior, May 23<sup>rd</sup> – 24<sup>th</sup>, 2019, Chicago, IL. Invited, but declined due to an unforeseen family obligation.
- 2018 **N. M. Timme**, From neural cultures to rodent models of disease: examples of information theory analyses of effective connectivity, computation, and encoding, CNS 2018 Information Theory Workshop, July 18<sup>th</sup>, 2018, Seattle, WA. Invited.
- 2015 **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 28<sup>th</sup>, 2015, Phoenix, AZ.
- 2015 **N. Timme**, Multivariate transfer entropy reveals degree dependent computation in networks of cortical slice culture neurons, Neurons, Circuits and Behavior Seminar, University of Oregon, April 28<sup>th</sup>, 2015, Eugene, OR. Invited.
- 2010 **N. Timme**, Vibration damping in a tennis racket, 159<sup>th</sup> Meeting of the Acoustical Society of America, April 19<sup>th</sup> – 23<sup>rd</sup>, 2010, Baltimore, MD. Invited, but declined.

## Posters

- 2020 **N. M. Timme**, M. Quintero, D. Linsenbardt, M. Timm, T. Galbari, E. Cornwell, and C. C. Lapish, Neural firing in medial prefrontal cortex reflects aversion-resistant and aversion-sensitive drinking behaviors in alcohol preferring P rats and Wistars, Research Society on Alcoholism Annual Meeting, June 20<sup>th</sup> – 24<sup>th</sup>, 2020, New Orleans, LA. Cancelled due to Covid-19.
- 2019 **N. M. Timme**, D. Linsenbardt, M. Timm, T. Galbari, E. Cornwell, and C. C. Lapish, Neural encoding in medial prefrontal cortex during aversion resistant drinking in rodent models of alcohol use disorder, Society for Neuroscience Annual Meeting, October 19<sup>th</sup> – 23<sup>rd</sup>, 2019, Chicago, IL.
- 2019 **N. M. Timme**, D. Linsenbardt, M. Timm, T. Galbari, E. Cornwell, and C. C. Lapish, Examining the role of medial prefrontal cortex in aversion resistant drinking in alcohol preferring P rats, Research Society on Alcoholism Annual Meeting, June 22<sup>nd</sup> – 26<sup>th</sup>, 2019, Minneapolis, MN.
- 2019 E. C. Cornwell, T. J. Galbari, B. Ma, C. C. Lapish, and **N. M. Timme**, Exploring alcohol consumption levels by alcohol preferring P rats and Wistars in a simple limited access task, Indiana Chapter of the Society for Neuroscience Annual Meeting, March 22<sup>nd</sup>, 2019, Indianapolis, IN.
- 2018 **N. M. Timme**, D. N. Linsenbardt, and C. C. Lapish, Using information theory and a Bayesian model to examine the factors that influence the decision to consume alcohol in a rodent model of alcoholism, Organization for Computational Neuroscience Annual Meeting, July 13<sup>th</sup> – 18<sup>th</sup>, 2018, Seattle, WA.
- 2018 **N. M. Timme**, D. N. Linsenbardt, and C. C. Lapish, A Bayesian model to explore the factors that influence the decision to drink in rodents, Research Society on Alcoholism Annual Meeting, June 16<sup>th</sup> – 20<sup>th</sup>, 2018, San Diego, CA.
- 2018 **N. M. Timme**, D. N. Linsenbardt, and C. C. Lapish, Alcohol cue and drinking intent encoding is diminished in the prefrontal cortex of alcohol preferring rats, Alcohol and the Nervous System Gordon Research Conference, March 4<sup>th</sup> – 9<sup>th</sup>, 2018, Galveston, TX.
- 2018 **N. M. Timme**, D. N. Linsenbardt, and C. C. Lapish, Using a Bayesian model to explore the behavioral factors that influence the decision to consume alcohol in rodents, Alcohol and the Nervous System Gordon Research Seminar, March 3<sup>rd</sup> – 4<sup>th</sup>, 2018, Galveston, TX.
- 2017 **N. Timme**, D. N. Linsenbardt, and C. C. Lapish, Alcohol consumption related decision-making encoding is altered in the prefrontal cortex of alcohol preferring rats, Society for Neuroscience Annual Meeting, November 11<sup>th</sup> – 15<sup>th</sup>, 2017, Washington, DC. Dynamic Poster.

- 2017 **N. Timme**, D. N. Linsenbardt, and C. C. Lapish, To drink or not to drink: altered decision-making related information encoding in the prefrontal cortex of alcohol preferring rats, Research Society on Alcoholism Annual Meeting, June 24<sup>th</sup> – 28<sup>th</sup>, 2017, Denver, CO.
- 2017 **N. Timme**, D. N. Linsenbardt, M. Myroshnychenko, and C. C. Lapish, Improvements to information theory analysis techniques throughout neuroscience with MATLAB support, Statistical Analysis of Neuronal Data Workshop, May 31<sup>st</sup> – June 2<sup>nd</sup>, 2017, Pittsburgh, PA.
- 2016 **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 11<sup>th</sup> – 16<sup>th</sup>, 2016, San Diego, CA.
- 2015 **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 5<sup>th</sup> - 8<sup>th</sup>, 2015, Salt Lake City, UT.
- 2014 **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 15<sup>th</sup> - 19<sup>th</sup>, 2014, Washington, DC.
- 2014 **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 10<sup>th</sup>, 2014, Indianapolis, IN.
- 2014 **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 26<sup>th</sup> - 31<sup>st</sup>, 2014, Québec City, Canada.
- 2013 **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 18<sup>th</sup>, 2013, Indianapolis, IN.

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## 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)
- 2010 – 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.

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## Teaching Experience

- Physics I Discussion**, Non-Calculus, 9 Sections, Indiana University
- Physics I Laboratory**, Non-Calculus, 4 Sections, Indiana University
- Physics I Discussion**, Calculus, 5 Sections, Indiana University
- Physics I Laboratory**, Calculus, 2 Sections, Indiana University

**Physics II Discussion**, Non-Calculus, 2 Sections, Indiana University

**Physics II Laboratory**, Non-Calculus, 4 Sections, Indiana University

**Physics II Discussion**, Calculus, 2 Sections, Indiana University

**Physics II Laboratory**, Calculus, 2 Sections, Indiana University

**Physics in the Modern World**, Grading, 1 Section, Indiana University

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## 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