Curriculum Vitae

Michael J. Catanzaro

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Education

- Ph.D. Mathematics, Wayne State University, March 2016.
- M.A. Mathematics, Wayne State University, December 2011.
- B.S. Physics, Wayne State University, December 2010.
- B.S. Mathematics, Wayne State University, December 2010.

Research Interests

- Stochastic currents, random walks on complexes, stochastic calculus on manifolds, higher Reidemeister torsion, combinatorial Hodge theory, Cerf theory.
- Topological data analysis, multiparameter persistence, homological properties of persistence modules.

Publications

Peer-reviewed articles

9. Catanzaro, Michael J.; Chernyak, Vladimir Y.; Klein, John R. *Exciton Scattering via Algebraic Topology*. Accepted to Journal of Topology and Analysis.
Available at doi:10.1142/S1793525319500110 arXiv:1505.02365.

8. Catanzaro, Michael J.; Chernyak, Vladimir Y.; Klein, John R. *A higher Boltzmann Distribution*. Journal of Applied and Computational Topology (2017). doi:10.1007/s41468-017-0006-9 arXiv:1506.06775

7. Catanzaro, Michael J.; Chernyak, Vladimir Y.; Klein, John R. *Stochastic Dynamics of Extended Objects in Driven Systems: I. Higher-Dimensional Currents in the Continuous Setting*, Chemical Physics, **481**, 2016. doi:10.1016/j.chemphys.2016.08.021 arxiv:1609.00336

6. Catanzaro, Michael J.; Chernyak, Vladimir Y.; Klein, John R. *Stochastic Dynamics of Extended Objects in Driven Systems II: Current Quantization in the Low-Temperature Limit*, Chemical Physics, **481**, 2016. doi:10.1016/j.chemphys.2016.08.020 arxiv:1609.00334

5. Catanzaro, Michael J.; Shi, Tian; Tretiak, Sergei; Chernyak, Vladimir Y. *Counting the number of excited states in organic semiconductors systems using topology*, J. Chem. Phys, **142**, 2015. doi:10.1063/1.4908560 arxiv:1612.03434

4. Catanzaro, Michael J.; Chernyak, Vladimir Y.; Klein, John R. *Kirchhoff's theorems in higher dimensions and Reidemeister torsion*, Homology, Homotopy, and Applications, **17**, 2015. doi:10.4310/HHA.2015.v17.n1.a8 arxiv:1206.6783

3. Li, Hao; Catanzaro, Michael J.; Tretiak, Sergei; Chernyak, Vladimir. *Excited-state structure modifications due to molecular substituents and exciton scattering in conjugated molecules*, Journal of Physical Chemistry Letters, **5**, 2014. doi:10.1021/jz4027198 arxiv:1612.03523

2. Catanzaro, Michael J.; Chernyak, Vladimir Y.; and Klein, John R. *On Kirchhoff's theorems with coefficients in a line bundle*, Homology, Homotopy, and Applications, **15**, 2013. doi:10.4310/HHA.2013.v15.n2.a16 arxiv:1207.2822

1. Catanzaro, Michael J. *Generalized Tonnetze*, J. Math. Music, **5**, 2011. doi:10.1080/17459737.2011.614448 arxiv:1612.03519

Preprints

1. Catanzaro, Michael J.; Chernyak, Vladimir Y.; Klein, John R. *On fluctuations of cycles in a finite CW complex*. Available at arxiv.org/abs/1710.07995

Books, In progress

1. Bruner, Robert R.; Catanzaro, Michael J.; May, J. Peter. *Characteristic Classes*. pp 97. Draft available at math.uchicago.edu/∼may/CHAR/charclasses.pdf.

Other publications

3. Catanzaro, Michael J. *A Topological Study of Stochastic Dynamics on CW Complexes*. Wayne State University Dissertations, **1433**, 2016. Available at digitalcommons.wayne.edu/oa_dissertations/1433/.

2. Catanzaro, Michael J. *Finitely Presented Modules over the Steenrod Algebra in Sage*. Master's thesis, Wayne State University, December 2011. Available at people.clas.ufl.edu/catanzaro/files/Essayfinal.pdf

1. Catanzaro, Michael J. *A user's guide: Dynamics and fluctuations of cellular cycles on CW complexes*, available at mathusersguides.com/enchiridion-vol-2-2016-mike-catanzaro/

Presentations

- *Geometric multiparameter persistence*, Topology and Dynamics Seminar, University of Florida, December 2017.
- *Stochastic Dynamics on CW complexes*, Applied Math and Analysis Seminar, Duke University, November 2017.
- *Stochastic Dynamics of Cellular Cycles*, Geometry, Topology, and Data Seminar, The Ohio State University, September 2017.
- *Stochastic Dynamics on CW Complexes*, Applied Topology in Bedlewo 2017, Bedlewo, Poland, June 2017.
- *Exciton Scattering for Topologists*, Topology and Dynamics Seminar, University of Florida, March 2017.

- *Stochastic Dynamics on CW Complexes*, two presentations given in Topology and Dynamics Seminar, University of Florida, October 2016.
- *The Topology of Higher-Dimensional Currents and Langevin Processes*, Non-Equilibrium Statistical Physics, Telluride, CO, July 2016.
- *Kirchhoff's laws in higher dimensions and Reidemeister torsion*, Topology Seminar, Brandeis University, November 2015.
- *On the Boltzmann distribution and Hodge theory*, Young Topologists' Meeting, EPFL, July 2015.
- *A generalization of the Boltzmann distribution & Hodge theory*, Graduate Student Topology and Geometry Conference, University of Illinois, March 2015.
- *Counting Electronic Excitations In Organic Systems Using Algebraic Topology*, Topology Seminar, Johns Hopkins University, April 2014.
- *Constructions in ∞-categories*, Talbot Workshop, 2014.
- *Counting Electronic Excitations In Organic Systems Using Algebraic Topology*, Topology Seminar, Wayne State University, February 2014.
- *Counting The Number Of Electronic Excitations In Branched Conjugated Molecules Using Algebraic Topology*, Physical Chemistry Seminar, Wayne State University, November 2013.
- *Kirchhoff's theorems in higher dimensions and Reidemeister Torsion*, Topology Seminar, Wayne State University, October 2013.
- *Counting Electronic Excitations using Cohomology*, Graduate Student Geometry and Topology seminar, University of Illinois Urbana-Champaign, May 2013.
- *Jet and Minijet Contributions to Transverse Momentum Correlations in High Energy Collisions*, The Undergraduate Physics Research Conference, Wayne State University, November 2009.
- *The Topology of Spaces of Triads*, The Undergraduate Mathematics Seminar, University of Michigan Dearborn, March 2010.
- *The Topology of Spaces of Triads and Generalized Tonnetze*, The Undergraduate Research Conference, Wayne State University, November 2009.
- *The Topology of Spaces of Triads*, The Young Mathematicians Conference, The Ohio State University, August 2009.

Research Experience

- Undergraduate Mentor, WSU & UF. Oversaw directed study of several undergraduate students on the methods of Topological Data Analysis, August 2015 - present.
- Graduate Research Assistant in Mathematics, WSU. Performed dissertation study and research, January 2012 - August 2014.
- Organizer of WSU Mathematics Student Seminar. Organized weekly undergraduate meetings and seminars, Fall 2011 - Spring 2013.

- Graduate Research Assistant, Los Alamos National Laboratory. Performed research on power grids and related algorithms, May 2012- August 2012.
- Research Assistant in Physics, WSU. Helped derive observable and performed high energy physics simulations, May 2009 - July 2010.

Teaching Experience

As the primary instructor, I developed syllabi, quizzes, and tests for the following courses.

- Advanced Topics in Topology: Differential Topology, Vector Bundles, and Characteristic Classes (7396): Fall 2017.
- Advanced Calculus for Engineers and Physical Scientists I (4102/5104): Winter 2017.
- Mathematics in Today's World (1000): Summer 2013.
- Elementary Statistics (1020): Summer 2014.
- Algebra with Trigonometry (1050): Summer 2011, Fall 2011, Fall 2014, and Winter 2015.
- Pre-Calculus (1800): Winter 2011.
- Linear Algebra (2250): Summer 2015.

As the primary lecturer, I taught the following courses.

- Calculus 3 (2313): Fall 2016.

Technical skills

- Proficient in C/C++, Fortran, Python, and Bash scripting.
- Written code for Sage, Pythia, Hijing, and Root.

Awards

- *Anderson Scholar Faculty Honoree*, University of Florida, College of Liberal Arts and Sciences, December 2017.
- *Bertram Eisenstadt Award for Outstanding Achievement in PhD Program*, Wayne State University, Department of Mathematics, May 2016.
- *Robert Irvan Endowed Mathematics Scholarship*, Wayne State University, Department of Mathematics, May 2015.
- *M.F. Janowitz Endowed Mathematics Scholarship*, Wayne State University, May 2014.
- *Maurice Zelonka Endowed Scholarship*, Wayne State University, Department of Mathematics, May 2013.
- *Outstanding Teaching Service*, Wayne State University, Department of Mathematics, May 2012.
- *Outstanding Undergraduate Award*, Wayne State University, Department of Mathematics, May 2010.

- *M.F. Janowitz Endowed Mathematics Scholarship*, Wayne State University, May 2010.
- *George B. Beard Student Prize for Excellent Presentation of Research*, Wayne State University, Department of Physics, November 2009.
- *Robert Irvan Endowed Mathematics Scholarship*, Wayne State University, Department of Mathematics, May 2009.
- *Vaden W. Miles Outstanding Undergraduate Award*, Wayne State University, Department of Physics, March 2009.
- *Undergraduate Scholarship*, Wayne State University, Department of Mathematics, May 2008.
- *Presidential Scholarship*, Wayne State University, June 2005.

Conferences attended

- Applied Topology in Bedlewo 2017, Bedlewo, Poland, June-July 2017.
- Applied and Computational Topology, Hausdorff Research Institute for Mathematics, April-May 2017.
- Joint Mathematics Meetings, Atlanta GA, January 2017.
- Stochastic Topology and Thermodynamic Limits, ICERM, October 2016.
- Non-Equilibrium Statistical Physics: from molecular materials to theoretical engineering, Telluride, CO, July 2016.
- Topology, Geometry, and Data Analysis, Ohio State University, May 2016.
- Midwest Topology Seminar, Ohio State University, May 2016.
- Midwest Topology Seminar, Wayne State University, October 2015.
- Young Topologists' Meeting, EPFL, July 2015.
- Midwest Topology Seminar, University of Chicago, May 2015.
- Stratified spaces in geometric and computational topology and physics, University of Wisconsin, March 2015.
- Graduate Student Topology & Geometry Conference, University of Illinois-Urbana-Champaign, March 2015.
- Midwest Topology Seminar, University of Illinois-Chicago, February 2015.
- MIT Talbot Workshop on Motivic Homotopy Theory, March 2014.
- Joint Mathematics Meetings, Baltimore MD, January 2014.
- Midwest Topology Seminar, Wayne State University, October 2013.
- Midwest Topology Seminar, University of Kentucky, May 2013.
- MIT Talbot Workshop on Chromatic Homotopy Theory, April 2013.

- Graduate Student Topology & Geometry Conference, University of Notre Dame, April 2013.
- Midwest Topology Seminar, Michigan State University, October 2012.
- Graduate Student Topology Conference, University of Indiana, April 2012.
- Midwest Topology Seminar, Northwestern University, March 2012.
- West Coast Algebraic Topology Summer School on Algebraic K-theory, July 2012.
- Midwest Topology Seminar, Illinois State University, October 2011.
- Midwest Topology Seminar, Wayne State University, October 2010.
- Midwest Topology Seminar, University of Michigan, February 2010.