# Matthew Titsworth                                     Curriculum Vitae

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EDUCATION

**University of Texas at Dallas** *9/2010-5/2016*

Ph.D. in Physics

- Dissertation Topic: *Arithmetic Properties of Anyonic Systems with Boundary.*
- Advisor: Tobias Hagge
- GPA: 3.75

M.S. in Physics

**University of Louisiana at Lafayette** *9/2002-5/2008*

B.S. in Physics
B.S. in Mathematics

RESEARCH INTERESTS

I am interested in the classification of small rank fusion categories and their module categories. My research focuses on determining their geometric and arithmetic information. Fusion categories generalize categories of finite group representations and are fundamental to the topological quantum computing paradigm. In two and three dimensions arithmetic data from fusion categories is used to create models of topological phases of matter. Module categories are used to describe boundaries and domain walls between topological phases.

GRANTS AND AWARDS

- 2011 American Physical Society Texas Section Meeting travel grant.
- 2012 Knots in Washington XXXV travel grant.
- 2013 University of Texas at Dallas Ph.D. Research Small Grant.
- 2013 Canadian-American-Mexican Graduate Student Conference travel grant.
- 2014 Texas Geometry and Topology Conference travel grant.
- 2014 AMS MRC travel grant.

PROFESSIONAL ACTIVITY

- Participant in 2013 CAP-APS-SMF Canadian-American-Mexican Graduate Student Conference.
- Participant in 2014 Banff International Research Station workshop on Subfactors and Fusion Categories.
- Participant in 2014 AMS Mathematics Research Communities program on Mathematics of Quantum Phases of Matter and Quantum Information.
- Visitor at Microsoft Station Q April, 2014.

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**PUBLICATIONS AND PREPRINTS**

T. Hagge and MT. "Geometric invariants for fusion categories." arxiv:1509.03275

E. Ardonne, P. Finch, and MT. "A classification of some $B_{p,2}$ categories." In preparation.

R. Johnson, S. Morrison, S. H. Ng. D. Penneys, J. Roat, MT, H. Tucker. "Rank 4 self-dual fusion categories with a nontrivial subcategory." In progress.

O. Vigil-Galan, M. Courel, J. A. Andrade-Arivizu, Y. Sanchez, M. Espindola-Rodriguez, E. Saucedo, D. Seuret-Jimenez, MT. "Route towards low cost-high efficiency second generation solar cells: current status and perspectives." Journal of Materials Science: Materials in Electronics, 2014. doi:10.1007/s10854-014-2196-4

L. Houston and MT. "The Temporal Uncertainty of a Message." International Journal of Engineering Science and Innovative Technology (IJESIT), 3(3),116. 2014

C. Bejan, MT, A. Hickl, and S. Harabagiu. "Nonparametric Bayesian Models for Unsupervised Event Coreference Resolution." Advances in Neural Information Processing Systems, 2009

R. Fontenot, W. A. Hollerman, MT, W. Fountain, M. Cristl, C. Thibodeaux, and B.M. Broussard. "Results from Two Low Mass Cosmic Ray Experiments Flown on the HASP Platform." AIP Conference Proceedings 1099, 1024. 2009.

**PRESENTATIONS AND POSTERS**

MT. "Computational (Multiplicity-Free Semi-Simple K-linear Rigid Monoidal) Category Theory." UTD Computational Sciences Seminar. April 28, 2015. Richardson, TX.

E. Ardonne, P. Finch, MT. "On the classification of fusion categories Grothendieck equivalent to $B_{p,2}$." AMS Special Session on Quantum Information and Fusion Categories, AMS Joint Mathematics Meeting. January 10-13, 2015. San Antonio, TX.

MT, H. Tucker, J. Roat, R. Johnson, D. Penneys, S.H. Ng. "Progress: Classification of Rank 4 Pseudo-Unitary Fusion Categories With All Objects Self-Dual." Mathematics Research Communities: Mathematics of Quantum Phases of Matter and Quantum Information. June 24-June 30, 2014. Snowbird, UT.

MT and T. Hagge. "A Software Package for Computing the Properties of Anyonic Systems." Canadian-American-Mexican Graduate Student Conference. August 14-19, 2013. Waterloo, ON.

MT and T. Hagge. "Fusion Categories and Anyonic Systems." Symposium on Novel Topological Quantum Matter. February 25-26, 2013. Richardson, TX.

MT. "String-Net Condensation and Its Applications to Quantum Computing." Knots in Washington XXXV. December 7-9, 2012. Washington, DC.

MT and T. Hagge. "Towards A Notion of Symmetry For Topological Phases." Texas Section of the APS Meeting. October 25-27, 2012. Lubbock, TX.

EMPLOYMENT

**University of Texas at Dallas**

*Teaching and Research Assistant* *1/2011-Present*

- I co-developed a construction for complete invariants of multiplicity-free fusion categories.
- I developed a Mathematica package for manipulating the arithmetic data for fusion and related categories. Associated with this is a database of information for many examples.
- I co-developed a Mathematica package for solving large systems of polynomial equations arising from monoidal categories which augments Gröbner basis methods. As part of this I developed and implemented a polynomial time algorithm for computing gauge and monoidal classes of fusion categories using geometric invariants.
- I built and deployed a distributed computing network using reclaimed computers and configured it for specialized research needs.
- I helped completely rewrite the undergraduate mechanics laboratory to connect material through the entire course.
- I developed and improved senior undergraduate laboratory experiments based around optical interferometry, Young's double slit experiment, and pulsed nuclear magnetic resonance.

**Language Compute Corporation**, Richardson, TX

*Software Engineer* *6/2008-6/2010*

- I developed a state-of-the-art algorithm using nonparametric Bayesian methods for unsupervised learning of event coreference.
- I developed algorithms for extraction and classification of temporal information for the ordering of events across multiple events and corpuses.
- I investigated the application of other techniques such as HMM, ERM, and HITS as relevant to specific tasks.
- I developed and deployed an API for integrating results from multiple natural language processing sources using Java.
- I executed multiple design and test roles such as writing documentation, implementing unit tests using JUnit, and deploying and maintaining the build checker.

**University of Louisiana at Lafayette**

*Undergraduate Research Assistant* *2/2003-5/2008*

- I developed image analysis techniques for determining cosmic ray paths.
- I induced mechanoluminecense from exotic phosphors.
- I adapted and modernized a software library for Rutherford backscattering spectroscopy using C++.

TEACHING
EXPERIENCE

**University of Texas at Dallas** *1/2011-*

- Phys 2125 Mechanics Lab - SP11, SP12, FA12, SP13
- Phys 2126 Electromagnetics Lab - SP14
- Phys 3312 Classical Mechanics - FA11, SP13
- Phys 4373 Physical Measurements Lab - FA14, SP15, FA15
- Phys 5302 Mathematical Methods for Physicists - SP14
- Phys 5311 Classical Mechanics - FA11
- Phys 6300 Quantum Mechanics - FA12, FA13

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| LANGUAGES | • English |
| COMPUTER SKILLS | • Programming Languages: Mathematica (Wolfram), Java, C++.<br>• Markup Languages: XML, RDF, JSON.<br>• Operating Systems: Linux (Red Hat, Ubuntu), Windows. |
| PROFESSIONAL MEMBERSHIPS | • American Physical Society<br>• American Mathematical Society |

REFEREES

Tobias Hagge (Advisor)
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Richland, WA 99354
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University Lecturer, Stockholm University
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Jason Slinker (Teaching)
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