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Education

UT Austin

2019-Present

Degree: Ph.D. in Mathematics

UC Berkeley

2015-2019

Degree: B.A. in Mathematics

Math courses: abstract algebra, linear algebra, real analysis, complex analysis, graduate topology and analysis (*Folland*), graduate complex analysis (*Ahlfors*), graduate group theory (notes on my [website](#)¹), graduate algebra (*Lang*), graduate commutative algebra (*Eisenbud/Matsumura*), graduate algebraic geometry (notes on my [website](#)¹), graduate Lie theory (notes on my [website](#)¹), graduate symplectic geometry (notes on my [website](#)¹), graduate model theory (notes on my [website](#)¹)

Physics courses: graduate general relativity, graduate quantum field theory (notes on my website [website](#)¹), electromagnetism, classical mechanics, quantum mechanics.

Research Experience

Reading course

UT Austin

Fall 2019, Spring 2020

Under the guidance of Professor David Ben-Zvi, I have been learning about the 2-category of sheaves of categories. I plan to continue to explore this topic in ways motivated by 3d mirror symmetry in Spring 2020.

Undergraduate senior thesis:

UC Berkeley

Fall 2018, Spring 2019

Under the guidance of Professor Vivek Shende, I worked on multiple questions concerning symplectic geometry and low-dimensional topology. Techniques included microlocal sheaf-theory, homotopy theory, and category theory. In the end I sketched a proof of a theorem related to Heegaard Floer homology of three-manifolds [5], and sketched a generalization of a proof of homological mirror symmetry for surfaces to higher-dimensional projective hypersurfaces [6].

Research project on Dean's Scholarship:

University College London

Summer 2017

I was awarded the Dean's Summer Scholarship at UCL for the summer of 2017. **This opportunity was effectively equivalent to an REU.** I completed a research project under the supervision of Professor Michael Singer investigating the asymptotic behavior of partial density functions on hermitian line bundles. My particular work primarily involved Kähler geometry and complex analysis, and resulted in some original contributions [3].

Directed reading program:

UC Berkeley

Fall 2017 - Present

Starting in the fall of 2017, I completed a guided reading project on a subject of my choosing. My first semester I focused primarily on category theory, learning from Tom Leinster's book "Basic Category Theory," as well as MacLane's "Categories for the Working Mathematician." I then spent some time learning algebraic

¹math.utexas.edu/users/vandyke/notes/notes.html

geometry from a categorical point of view. I spent my second semester learning algebraic number theory also from a somewhat category theoretic point of view.

Fission Reaction Event Yield Algorithm:

Lawrence Berkeley National Laboratory

Spring 2017 - Present

Over the past year I have worked on developing an analysis methodology that allows us to fix the parameters in the fission simulator FREYA.

Publications

- [1] Antonio Alfieri and Jackson Van Dyke, *An introduction to knot Floer homology and curved bordered algebras*, arXiv e-prints (2018Nov), arXiv:1811.07348, available at [arXiv:1811.07348](https://arxiv.org/abs/1811.07348).
- [2] J. Van Dyke, L.A. Bernstein, and R. Vogt, *Parameter optimization and uncertainty analysis of freya for spontaneous fission*, Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment **922** (2019), 36 –46.
- [3] J. Ross, M. Singer, and J. Van Dyke, *Asymptotics of partial density functions*. In preparation.
- [4] A. Schmäh, N. Buechel, S. Garrett, M. Lomnitz, X. Sun, J. Van Dyke, J. Xu, and J. Zhang, *Radiation Hardness Test of Eljen EJ-500 Optical Cement*, ArXiv e-prints (March 2017), available at [arXiv:1703.10606](https://arxiv.org/abs/1703.10606).
- [5] J. Van Dyke, *The Fukaya category of some objects in low-dimensional topology*, In preparation (2019).
- [6] ———, *Trapping disks in high-dimensional projective hypersurfaces*, In preparation (2019).

Talks Given

Junior Geometry and String Theory Seminar

UT Austin

Fall 2019

Triangulation conjecture Seminar

UT Austin

Fall 2019

Scholarship Project Presentation

University College London

August 2017

University Program Review (UPR) Presentation

University of Michigan, Ann Arbor

June 2018

Nuclear Fission Conference (NA22 collaboration):

Santa Fe, NM

March 2017

Teaching Experience

Graduate Student Instructor:

University of Texas, Austin

Multivariable Calculus, Series, Sequences

Fall 2019

I held section, wrote and administered quizzes, graded assignments, and held office hours.

Undergraduate Student Instructor:

University of California, Berkeley

Calculus, ODEs, Linear Algebra

Fall 2018

I held section, wrote and administered quizzes, graded assignments, and held office hours.

Summer Program in Nuclear Physics:

University of Oslo, Oslo, Norway

May 2017

I helped develop the curriculum for, and teach a course concerning the physics of nuclear fission and our ability to model it. This happened in conjunction with my research in theoretical nuclear physics developing the fission event algorithm FREYA.

Conferences Attended

New Perspectives in Gromov-Witten Theory:

IMJ-PRG, Sorbonne Universit, Paris

June 3 - June 7, 2019

Princeton Summer School in Low-dimensional Topology and Symplectic Geometry:

Princeton University, Princeton, NJ

June 11 - June 29, 2018

From website:

A three-week intensive program (June 11-29, 2018) at Princeton University for 25 advanced undergraduates and first year graduate students consisting of courses in low dimensional topology and symplectic geometry. Topics will include low-dimensional topology, gauge theory, and pseudo-holomorphic curves. There will be six courses, consisting of five lectures apiece. Daily lectures will be complemented by review and problem sessions.

Enumerative Geometry Beyond Numbers:

MSRI, Berkeley CA

January 22, 2018 - January 26, 2018

From website:

Traditional enumerative geometry asks certain questions to which the expected answer is a number: for instance, the number of lines incident with two points in the plane (1, Euclid), or the number of twisted cubic curves on a quintic threefold (317 206 375). It has however been recognized for some time that the numerics is often just the tip of the iceberg: a deeper exploration reveals interesting geometric, topological, representation-, or knot-theoretic structures. This program will be devoted to these hidden structures behind enumerative invariants, concentrating on the core fields where these questions start: algebraic and symplectic geometry.

Honors and Awards

Dean's Honors List - College of Letters and Science:

UC Berkeley

Spring 2018, Fall 2019

The Dean's Honors List recognizes outstanding academic achievement each fall and spring semester. To earn Dean's Honors for a semester, the criteria are:

- 13 or more letter-graded units that semester
- Semester GPA in the top 10% of L&S undergraduates
- No disqualifying grades that semester (I, NR, or NP grades or courses for which no grades have been submitted).

International Dean's Summer Scholarship:

University College London

Summer 2017

I spent the summer of 2017 doing research under Professor Michael Singer with support from the International Dean's Summer Scholarship from UCL. This is analogous to an REU opportunity in the United States.

Skills

Type-setting: I have been typesetting all of my assignments and notes with \LaTeX for multiple years. I take a large majority of my notes in real time.

Computer science: High level: Python, Low-level: C++, fortran, bash. I have also worked extensively with clusters and techniques such as parallel processing for working with computationally intensive projects. Specifically I have had experience with both computational geometry and analysis of large data sets.