

Yu (Leon) Liu

leon.liu@utexas.edu

<http://leon2k2k2k.github.io>

November 30, 2020

Education

- **The University of Texas at Austin**

B.S. in Mathematics

Austin, Texas

September 2017- **December 2020**

- Major: Pure Mathematics
- Cumulative GPA: 3.93/4.0
- Mathematics GPA: 3.93/4.0
- Expected Graduation: December 2020

Research Projects

- **Abelian Duality in Topological Field Theory**

August 2020- December 2020

Mathematical Physics

- See **here** for a draft.
- My senior thesis with Professor Dan Freed.
- I formulate and proof a version of electromagnetic duality for finite abelian gauge groups as equivalences of TFTs (up to tensoring with an invertible TFT), following [FT] .

- **The Geometry of Soergel Bimodules**

May 2020 -

Geometric Representation theory, Homotopy Theory

- In collaboration with Aaron Mazel-Gee (Cal-Tech) and David Reutter (Max Planck), both postdocs.
- We are constructing a spectral version of Soergel bimodules and their braid group actions, using the formalism of spherical functors.

- **Homotopy Type Theory**

January 2020 -

Formal verification, HoTT

- See <https://github.com/LaufferN/HoTT-Arend>
- Translate and verify the theorems in *Homotopy Type Theory: an Univalent Foundation* into Arend, a theorem prover using homotopy type theory.

Organizations

- **Electromagnetic Duality**

September 2020- December 2020

Organizer

- See https://leon2k2k2k.github.io/EM_duality_and_Geo_Lang
- Organized a seminar about electromagnetic duality in 4D supersymmetric gauge theories and the connection to the geometric Langlands program.
- Responsible for scheduling talks, inviting speakers.

- **UT Mathematics Club**

January 2018 - December 2020

President 2019-2020, Vice President 2018-2019

- Organized weekly meetings, responsible for contacting professors, scheduling the lectures, as well as preparing food and drinks for the lectures.
- Created a platform where undergraduate mathematics students can practice their lecture skills.
- Created workshops for Latex, GRE, and organized graduate student panels for UT undergraduates who are interested in math grad school.

- **Homotopy Type Theory Class**

January 2020- May 2020

Organizer

- Created joint CS-mathematics course on Homotopy Type Theory.
- Creating an Arend documentation for the theorems and proofs in *Homotopy Type Theory: an Univalent Foundation*.

• **Sunday Morning Math Group**

January 2020 - May 2020

• *Volunteer*

- Volunteered at UT's Sunday Morning Math Group (SMMG).
- Introduced interesting math concepts to K-12 students.

Conference & Summer Programs

- **Tensor Categories and Topological Quantum Field Theories** March 2020
MSRI, moved online
- **(∞, n) -Categories, Factorization Homology, and Algebraic K-Theory** March 2020
MSRI, moved online
- **Summer School on Homological Algebra in Mirror Symmetry** August 2019
Fields Institute, Toronto
- **Park City Mathematics Institute: QFT and Manifold Invariants** July 2019
Park City, Utah
- **Arizona Winter School: Topology and Arithmetic** March 2019
University of Arizona, Arizona
- **Texas Algebraic Geometry Symposium** February 2019
UT Austin, Texas
- **Between Topology and Quantum Field Theory** January 2019
UT Austin, Texas
- **Texas Algebraic Geometry Symposium** November 2018
Texas A&M, Texas

Relevant Courses Taken

M373 Algebra	A
M275 Algebraic Geometry	A
M375 Homotopy Theory	A
M375 Riemannian Geometry	A
M375 Riemann Surfaces	A
M475 p-adic Homotopy Theory	A-
M475 Representation theory	A
M375T Analysis On Manifold	A
M375 Geometric Langlands Conjecture	A
M380D Algebra†	A-
M382D Differential Topology†	A
M385C Theory of Probability†	A
M392C Morse Theory†	A
M392C Algebraic Geometry†	A
M392C Mathematical Gauge Theory †	A
M392C Stability Conditions †	A
M392C P-adic Hodge Theory †	A
M392C Gromov-Witten Theory †	A
PHY387M Relativity Theory †	A
PHY396K Quantum Field Theory †	A
PHY396P String Theory †	A-
CS370 Homotopy Type Theory	A
M379H Honor Thesis *	

* = Current Courses

† = Graduate Courses

All M#75 courses are conference (reading) courses, for these courses, the topics are given above.

Honors and Awards

- **Emory and Ella Peterson Endowed Presidential Scholarship** April 2020
UT Austin
- **Jennifer T. Barrett Undergraduate Scholarship** September 2019
UT Austin
- **UT Distinguished College Scholar** 2018-2020
UT Austin

Selected Talks Given

- **Fourier Theory and Categorification** November 2020
Junior Geometry
- **Abelian Dualities in Topological Field Theory** November 2019
Junior Geometry and String Theory
- **EM Duality in N=4 SUSY Yang-Mills** October 2020
EM duality and Geometric Langlands Seminar
- **EM Duality in N=2 SUSY Yang-Mills** September 2020
EM duality and Geometric Langlands Seminar
- **Electromagnetic Duality and Magnetic Monopoles** September 2020
Junior Geometry and String Theory Seminar
- **Representation Theory in Physics: Classification of Particles in QFT** April 2020
Junior Geometry
- **Renormalization of Perturbative Quantum Field Theories** February 2020
Junior Geometry and String Theory Seminar
- **Spontaneously Broken Symmetry and Higgs Mechanism** February 2020
Dynamics of QFT Seminar
- **Line Bundles and Divisor Correspondence** February 2020
Junior Algebraic Geometry Seminar
- **Proof of Triangulation Conjecture** November 2019
Triangulation Conjecture Seminar
- **T-duality on 2D Sigma Models** November 2019
Junior Geometry and String Theory Seminar
- **Seibert-Witten Equation and the Coulomb Gauge** October 2019
Triangulation Conjecture Seminar
- **Topological Hochschild Homology and Applications to Arithmetic Geometry** May 2019
Directed Reading Program
- **2-shifted Symplectic Structure on the Derived Stacks of Perfect Complexes** May 2019
Derived Algebraic Geometry Seminar
- **Derived Stack of Perfect Complexes and Its Cotangent Bundle** April 2019
Derived Algebraic Geometry Seminar
- **Shifted Symplectic Structure on Intersections of Lagrangians** April 2019
Derived Algebraic Geometry Seminar
- **Bauer-Furuta Invariants** April 2019
Furuta 10/8 Seminar
- **A_∞ categories and derived Fukaya categories** March 2019
Floer Lagrangian Seminar
- **Introduction to Morse Theory via Pictures** February 2019
UT Math Club
- **Finite Dimensional Approximations to the Monopole Map** February 2019
Furuta 10/8 Seminar

- **Bar Construction** January 2019
UT Math Club
- **Moduli Space of Triangles** September 2018
UT Math Club
- **Category Theory and Linear Algebra** April 2018
UT Math Club
- **27 Lines** February 2018
UT Math Club
- **Elliptic Curves are Group Schemes** November 2017
Directed Reading Program
- **Bezout's Theorem** October 2017
UT Math Club