Yu (Leon) Liu

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Education

- **Harvard University** — August 2020 - Present
  Ph.D. in Mathematics
- **The University of Texas at Austin** — August 2017 - December 2020
  B.S. in Mathematics

Research Projects

- **Abelian Duality in Topological Field Theory** — August 2020 - Present
  Mathematical Physics
  - Available **here**.
  - Senior thesis with Professor Dan Freed.
  - I prove electromagnetic duality for finite abelian gauge groups as equivalences of topological field theories (up to tensoring with an invertible TFT), following Freed-Teleman [FT] .

- **The Geometry of Soergel Bimodules** — May 2020 - Present
  Geometric Representation Theory, Homotopy Theory
  - In collaboration with Aaron Mazel-Gee (Caltech) and David Reutter (Max Planck), both postdocs.
  - We are constructing spectral versions of the Hecke categories and their braid group actions, using the formalism of spherical functors.

Organizations

- **S-Duality and Geometric Langlands** — September 2020 - December 2020
  Organizer
  - Organized a seminar about S-duality in 4D supersymmetric gauge theories and the connection to the geometric Langlands program.
  - Responsible for scheduling talks and inviting speakers.

- **UT Mathematics Club** — January 2018 - May 2020
  President 2019-2020, Vice President 2018-2019
  - Organized weekly meetings, contacted professors, and scheduled lectures.
  - Organizer for MUST, a platform for undergraduates to practice giving talks to their peers and receive constructive feedback.
  - Created GRE and LaTex workshops.

- **Homotopy Type Theory Class** — January 2020 - May 2020
  Organizer
  - Co-organized joint CS-mathematics course on Homotopy Type Theory.

- **Sunday Morning Math Group** — January 2020 - May 2020
  Volunteer
  - An UT outreach program aimed to encourage K-12 students to pursue STEM in college and beyond.

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*
M375 Geometric Langlands Conjecture . . . . *A*
M475 p-adic Homotopy Theory . . . . *A-*
M475 Koszul Duality . . . . *A*
M375T Analysis On Manifold . . . . *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

- **Dean's Honor Graduate with Research Distinction** — December 2020
  UT Austin
- **Mathematics Department Honors** — December 2020
  UT Austin
- **Emory and Ella Peterson Endowed Presidential Scholarship** — April 2020
  UT Austin
- **Jennifer T. Barrett Undergraduate Scholarship** — September 2019
  UT Austin
- **UT Distinguished College Scholar** — August 2018 - May 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
- **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 the 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 Stack of Perfect Complexes** — May 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

- **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