Ayodeji Lindblad

Curriculum Vitae

77 Massachusetts Avenue
Cambridge, MA
USA

Education

2023–2028 **Ph.D. in Mathematics**, *Massachusetts Institute of Technology*, Cambridge, MA.
Advised by Tomasz Mrowka

2019–2023 **B.S. in Mathematics**, *Massachusetts Institute of Technology*, Cambridge, MA.

Fellowships

2023–2028 **Dean of Science Fellowship**, *Massachusetts Institute of Technology*, Cambridge, MA.
Through a partnership with the School of Science, the Office of the Dean for Graduate Education and the science departments at MIT, the Dean of Science offers a fellowship to 20 graduate students each year.

Research papers

Designs related through Hopf and projective maps, *In Discrete & Computational Geometry*, doi.org/10.1007/s00454-025-00805-7.
We present infinite families of efficient constructions which build t-designs on spheres by placing t-designs on the Hopf and projective fibers associated to $\lfloor t/2 \rfloor$-designs on quotient spheres or projective spaces.

Asymptotically optimal t-design curves on S^3, *Preprint*, arXiv:2408.04044.
We prove existence of asymptotically optimal t-design curves on the 3-sphere, resolving a question of Ehler and Gröchenig.

Asymptotically small generalizations of t-design curves, *Preprint*, arXiv:2505.03056.
We introduce *weighted* and *approximate t-design curves* and present infinite families of efficient constructions of these objects from t-designs on spheres and complex projective spaces respectively. Using these constructions, we prove existence of weighted t-design curves on any sphere and ε_t-approximate design curves ($\varepsilon_t \asymp 1/t$ as $t \to \infty$) on any odd-dimensional sphere which achieve an asymptotic order of length matching a lower bound on the asymptotic order of length of a spherical t-design curve, resolving all open weighted and all open odd approximate analogues of the question of Ehler and Gröchenig of proving existence of asymptotically optimal t-design curves on spheres. We present explicit asymptotically optimal weighted t-design curves for all t on the 2-sphere and 3-sphere.

Abelianized boundary Dehn twists on complete intersections, *Preprint, available upon request*.
Work of Kronheimer-Mrowka, Baraglia-Konno, and Jianfeng Lin shows that the boundary Dehn twist on punctured X is nontrivial for X the $K3$ surface, the once-stabilized $K3$ surface, or any one of infinitely many complete intersections. For X any of these spaces, we build a smooth X-bundle over T^2 whose total space is not spin to prove that the boundary Dehn twist on punctured X is trivial after abelianization. This generalizes work of Yujie Lin, which applied the global Torelli theorem and an obstruction of Baraglia-Konno to prove the corresponding statement for X the $K3$ surface.

Lifting design curves, *Preprint, available upon request*.
We formalize an efficient construction which builds a t-design curve on the $(2n+1)$-sphere from a $\lfloor t/2 \rfloor$-design curve on the $2n$-dimensional complex projective space. This result is combined with a construction of design curves on projective spaces to give improved bounds on the minimal asymptotic order of length of a sequence of t-design curves on all spheres of dimension greater than 4.

Dynamical stability of translators under mean curvature flow, *Posted to MIT SPUR website*, advised by Tang-Kai Lee, joint with Carlos Alvarado.
Convergence under mean curvature flow of codimension 2 curves in a certain family to a line is proven. Similar results for hypersurfaces are presented.

Expository work

Instanton Floer homology and applications, *To appear as a chapter in the book New Structures in Low-Dimensional Topology*, joint with John Baldwin, Joye Chen, Nathan Geist, Tomasz Mrowka, and Ollie Thakar.
Instanton Floer homology—a powerful invariant of 3-manifolds—is defined and applications to low-dimensional topology are presented. These notes follow a mini-course presented at the meeting *New structures in low-dimensional topology* in Budapest.

Khovanov Skein lasagna modules for the working topologist, *In preparation*, joint with Enrico Colon, Gage Martin, and Mira Watal.
Khovanov skein lasagna modules are presented and their impacts discussed from the perspective of low-dimensional topology.

Diffeomorphisms of 4-manifolds, *In preparation*.
A survey is provided of results concerning diffeomorphisms of 4-manifolds present in the literature as of the end of 2025

Mentorship

2024–2025 **MIT Grad-Undergrad Math Mentoring Initiative**.
Met with an undergraduate to discuss preparing for graduate school in mathematics.

January 2024 **MIT Directed Reading Program**.
Led three MIT undergraduates in reading through *The Knot Book* by Colin Adams.

September–December 2023 **Mentoring undergraduate research**.
Mentored UROP student Roni Edwin alongside Professor Henry Cohn on a problem in discrete geometry.

Seminar and conference talks

March 2025 **MIT PuMaGraSS**, *Geometrically designing geometric designs*.
Discussed geometric constructions of spherical t-designs and t-design curves.

October 2024 **MIT Juvitop**, *Monopole Floer homology and a refinement of Manolescu*.
Gave an overview of the construction of monopole Floer homology and discussed a refinement due to Manolescu involving finite-dimensional approximations of the Seiberg-Witten map which produces a space whose homotopy groups are the monopole Floer homology groups.

October 2024 **MIT PuMaGraSS**, *In case you're curious what your local low-dimensional topologists do all day*.
Spoke about Morse theory and Floer theories.

April 2024 **AMS Spring Eastern Sectional FRACTals**, *Designs related through projective and Hopf maps*.
Provided an overview of my manuscript of the same name.

Conferences and workshops organized

April 2025 **The Low-dimensional Princeton-Cambridge Exchange Conference (The Low PriCE Conference)**, *MIT and Harvard*, organized with Ollie Thakar.

Conferences and workshops attended

Dec. 2025 **2025 Virginia topology conference**, *UVA*.
August 2025 **Workshop: Low-Dimensional Topology and Floer Theory**, *CRM*.
August 2025 **Workshop: Knots, Groups, and Manifolds**, *CRM*.
June 2025 **2025 Modern Tools in Low-Dimensional Topology Summer School and Conference**, *ICTP*.
May 2025 **2025 Georgia International Topology Conference**, *UGA*.
May 2025 **Links in Dimensions 3 and 4**, *ICERM*.
April 2025 **2025 Graduate Student Topology and Geometry Conference**, *IU Bloomington*.
April 2025 **The Low-Dimensional Princeton-Cambridge Exchange Conference (The Low PriCE Conference)**, *MIT and Harvard*.
March 2025 **2025 Simons Collaboration on New Structures in Low-Dimensional Topology**, *NYC*.
March 2025 **2025 Simons Collaboration Satellite Conference**, *Princeton University*.
Dec. 2024 **Foliations and Diffeomorphism Groups**, *CIRM*.
July 2024 **New Structures in Low-Dimensional Topology Summer School and Conference**, *The Rényi Institute*.
June 2024 **41st Workshop in Geometric Topology**, *Calvin University*.
May 2024 **2024 Georgia Topology Summer School and Conference**, *UGA*.
April 2024 **2024 Graduate Student Topology and Geometry Conference**, *MSU*.
April 2024 **2024 AMS Spring Eastern Sectional Meeting**, *Howard University*.
March 2024 **2024 Simons Collaboration on New Structures in Low-Dimensional Topology**, *NYC*.
March 2024 **2024 Simons Collaboration Satellite Conference**, *Princeton University*.

March 2024 **Hot Topics: Artin Groups and Arrangements - Topology, Geometry, and Combinatorics**, *SLMath*.

January 2024 **Equivariant Methods in Geometry**, *Cambridge University*.

August 2023 **Early Career Symposium for Topology, Actions, and Symmetry**, *University of Southampton*.

July 2023 **Gauge Theory and Topology: in Celebration of Peter Kronheimer's 60th Birthday**, *Oxford University*.

July 2023 **RTG Summer School in Geometry and Topology**, *Princeton University*.

June 2023 **40th Workshop in Geometric Topology**, *Colorado College*.

June 2023 **New Developments in 3- and 4-Manifold Topology**, *UVA*.

May 2023 **Discrete and Computational Geometry, Shape Analysis, and Applications**, *Rutgers University*.

Summer 2022 **MIT Summer Program in Undergraduate Research**, *MIT*.

Academic Record

GPA

- MIT: 5.0/5.0
- Other institutions: 4.0/4.0

Mathematics coursework

- Harvard Math 252Z Gauge theory and related tools (G) - Peter Kronheimer
- Harvard Math 254Z Applications of Khovanov homology in low-dimensional topology (G) - Gage Martin
- 18.137 Topics in Geometric PDEs (G) - Tobias Colding
- Harvard Math 285Z Sutured 3-Manifolds and Floer Homology (G) - Fan Ye
- 18.966 Geometry of Manifolds II (Mean Curvature Flow) (G) - William Minicozzi
- 18.906 Algebraic Topology II (G) - Tomasz Mrowka
- Harvard Math 293X Topological Modular Forms (G) - Stephen McKean
- 18.966 Geometry of Manifolds II (Minimal Surfaces) (G) - Tobias Colding
- 18.821 Project Lab in Mathematics (U) - Andrei Negut
- 18.S995 Discrete Geometry (G) - Henry Cohn
- 18.966 Geometry of Manifolds II (G) - Tobias Colding
- 18.904 Seminar in Topology (U) - Anthony Conway
- 18.965 Geometry of Manifolds I (G) - William Minicozzi
- 18.905 Algebraic Topology I (G) - Jeremy Hahn
- 18.600 Probability and Random Variables (U) - Jonathan Kelner
- 18.157 Microlocal Analysis (G) - Peter Hintz
- 18.702 Algebra II (U) - Michael Artin
- 18.952 Theory of Differential Forms (U) - Victor Guillemin
- 18.155 Differential Analysis I (G) - Tomasz Mrowka
- 18.701 Algebra I (U) - Bjorn Poonen
- 18.101 Analysis and Manifolds (U/G) - Richard Melrose
- 18.102 Functional Analysis (U/G) - Richard Melrose
- 18.100B Real Analysis (U/G) - Roman Bezrukavnikov
- 18.900 Geometry and Topology in the Plane (U) - Paul Seidel
- 18.700 Linear Algebra (U) - David Vogan
- Community College of Baltimore County MATH 253 Calculus III (U) - Robert Brown
- Johns Hopkins University MATH 302 Differential Equations (U) - Richard Brown
- University of California San Diego MATH 18 Linear Algebra (U) - Laura Stevens