

KEITA ALLEN (HE/HIM)

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MATHEMATICAL INTERESTS

Homotopy theory, algebraic topology, algebraic geometry.

EDUCATION

Massachusetts Institute of Technology Cambridge, MA
Candidate for Ph.D. in mathematics. Expected 2023 – 2028

Massachusetts Institute of Technology Cambridge, MA
B.S. in mathematics, GPA: 5.0/5.0. 2019 – 2023

Southland College Prep Charter High School Richton Park, IL
High school diploma. 2015 – 2019

SHORT-TERM VISITS

Nagoya University Graduate School of Mathematics Nagoya, Japan
Visiting researcher with Lars Hesselholt Summer 2023

AWARDS AND FELLOWSHIPS

National Defense Science and Engineering Graduate (NDSEG) Fellowship 2023 – 2026

MIT Math Dept. Teaching and Learning Award May 2022
Presented by MIT Math Dept. for excellence in undergraduate teaching.

UNDERGRADUATE PROJECTS

Computing the homology of the motivic lambda algebra. The University of Chicago REU
Mentors: Mark Behrens, Peter May Summer 2022

- Investigating generalizations of the Curtis algorithm (for computing the E_2 page of the Adams spectral sequence) to computing the E_2 page of the motivic Adams spectral sequences, over the base fields \mathbb{C} and \mathbb{R} .
- Writing computer program to facilitate generation of Curtis tables, which allow us to reconstruct the motivic Adams E_2 pages. Some code is available at <https://github.com/ktallen/PyLambdaCalc>.
- Preliminary draft available at <http://math.uchicago.edu/~may/REU2022/REUPapers/Allen.pdf>; paper presents a Curtis algorithm for computing the \mathbb{C} -motivic Adams E_2 page.

Complexity of computing the homotopy groups of spheres. MIT Math Dept.
Mentors: Robert Burklund, Haynes Miller Summer 2021

- Studied complexity of algorithm outlined by E.H. Brown in *Finite Computability of Postnikov Complexes*, which allows for the computation of the homotopy groups of any space obtained as the realization of a finite simplicial set.
- Gave explicit bounds on the runtime of this computation in the case of finite homotopy groups, and as particular examples of spaces with infinite homotopy groups, gave explicit bound on the computation of homotopy groups of odd-dimensional spheres.

- Preliminary draft available at <https://math.mit.edu/research/undergraduate/urop-plus/documents/2021/Allen.pdf>.

EXPOSITORY TALKS

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| Chromatic homotopy theory and p-divisible groups.
<i>Babytop seminar</i> | September 2023
MIT |
| The lambda algebra in classical and motivic homotopy theory.
<i>The University of Chicago REU</i> | August 2022
The University of Chicago |
| Computing the homology of the \mathbb{C}-motivic lambda algebra.
<i>Leadership Alliance National Symposium</i> | July 2022
Virtual |
| Spectra and cohomology theories.
<i>Chroma 2022 summer homotopy theory seminar</i> | June 2022
Virtual |

TEACHING

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| 18.02 (multivariable calculus)
<i>Undergraduate TA</i> | MIT Math Dept.
Spring 2022 |
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- Taught twice-weekly recitation section, created problems for recitation, held office hours and review sessions, and graded. Please find some of the material I created [here](#).
 - Student evaluations: *Stimulated interest*: 6.8/7.0, *Displayed thorough knowledge of subject material*: 6.9/7.0, *Helped me learn*: 7.0/7.0.
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|---|--------------------------------|
| 18.02A (accelerated multivariable calculus)
<i>Undergraduate TA</i> | MIT Math Dept.
January 2022 |
|---|--------------------------------|
- Taught two twice-weekly recitation sections, held office hours and graded.
 - Student evaluations: *Stimulated interest*: 6.7/7.0, *Displayed thorough knowledge of subject material*: 7.0/7.0, *Helped me learn*: 7.0/7.0.
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| MIT Talented Scholars Resource Room
<i>Tutoring Facilitator</i> | MIT Office of Minority Education
Spring 2021 – Fall 2022 |
|---|---|
- Tutoring MIT students in math subjects through one-on-one appointments, facilitated group study sessions, walk-in office hours, and exam reviews. Courses tutored include:

18.01/A	<i>single variable calculus</i>	18.02/A	<i>multivariable calculus</i>	18.03	<i>differential equations</i>
18.04	<i>complex variables</i>	18.06	<i>linear algebra</i>	18.600	<i>probability</i>
18.701	<i>abstract algebra I</i>				
 - Overall rating: 5.0/5.0.
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| Interphase EDGE
<i>Residential Calculus Facilitator</i> | MIT Office of Minority Education
Summer 2020, 2021 |
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- TA for course in multivariable calculus, during residential program for rising MIT first-year students from underprivileged backgrounds.
 - Responsible for crafting problem sets and recitation sheets, recitations twice weekly, holding office hours, and holding exam review sessions. Please find some of the material I helped create [here](#).
 - Hosted events as peer mentor/consultant for program participants in order to facilitate successful transition into MIT.

OTHER ACTIVITIES

Associate Advisor – MIT Office of Minority Education

Fall 2021 – Spring 2023

- Leading activities for advising group of first-year students and acting as peer mentor.

Chroma 2022

Summer 2022

Harvard/MIT summer seminar in stable/chromatic homotopy theory.

Co-organizer

- Helped organize an undergraduate-focused seminar in stable/chromatic homotopy theory. Covered foundational topics in stable homotopy theory, building towards the chromatic point of view.

Grader – MIT Math

Spring 2020

- Graded problem sets for 18.03 (differential equations).

SKILLS

Language

English (Native), Japanese (Native)

Programming & Markup

Comfortable with Python, \TeX