

ALEXANDER J. DUNN

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Research interests

Analytic number theory, automorphic/metaplectic forms and their representations, L -functions, primes, spectral theory, partitions, theta functions, class numbers, circle method and exponential sums.

Employment

July 2023– **Georgia Institute of Technology (Georgia Tech), USA**
Tenure track Assistant Professor, School of Mathematics
Sept 2020–June 2023 **California Institute of Technology (Caltech), USA**
Olga Taussky & John Todd Instructor (postdoc) in Mathematics
Jan 2021–Apr 2021 **Institut Mittag-Leffler, Sweden**
Junior Fellowship (Number theory program: online)

Education 2020 **University of Illinois at Urbana–Champaign, USA**
Ph.D. (Mathematics)
Advisors: Professors Scott Ahlgren and Alexandru Zaharescu
Thesis: *Analytic and arithmetic applications of half integral weight automorphic forms*
2015 **University of Queensland, Australia**
Master of Philosophy (Mathematics)
2013 **University of Queensland, Australia**
Bachelor of Science Honours I, awarded with a University Medal

Postdoctoral awards and honours

2022 Research featured in: [Quanta](#), [IFLScience](#), [Caltech news](#), [Illinois news](#)

Graduate awards and honours

2020 Bateman Prize in Number Theory, UIUC
Bateman Fellowship in Number Theory, UIUC
2018 UIUC Campus Research Board Grant (with Scott Ahlgren)
2013 Australian Postgraduate Award Scholarship

Undergraduate awards and honours

2013 University Medal, U.Queensland
2013 The Ethel Raybould Prize in Mathematics, U.Queensland
2013 Valedictorian, Faculty of Science, U.Queensland
2011 The Maude Walker Prize, Faculty of Science, U.Queensland
2010 Excellence Scholarship (valued at 24k AUD), U.Queensland

Papers and preprints

- **Quartic Gauss sums over primes and metaplectic theta functions**, (with C. David, A. Hamieh, and H. Lin), [\[arxiv\]](#) 35 pp.
- **Bias in cubic Gauss sums: Patterson’s conjecture**, (with M. Radziwiłł), *Submitted* [\[arxiv\]](#) 77 pp.
- **On a problem of Hoffstein and Kontorovich**, *Submitted* [\[arxiv\]](#) 24 pp.
- **Bilinear forms in Weyl sums for modular square roots and applications**, (with B. Kerr, I.E. Shparlinski and A. Zaharescu), *Adv. Math.* 375 (2020) [\[arxiv\]](#).
- **The twisted second moment of modular half integral weight L -functions**, (with A. Zaharescu), *Submitted* [\[arxiv\]](#) 58 pp.
- **Maass forms and the mock theta function $f(q)$** , (with S. Ahlgren), *Math. Ann.* 374 (2019), no. 3-4, 1681–1718. [\[arxiv\]](#)
- **Sums of Kloosterman sums over primes in an arithmetic progression**, (with A. Zaharescu), *Q.J. Math.* 70 (2019), no. 1, 319–342. [\[arxiv\]](#)

- **Uniform estimates for sums of Kloosterman sums of half integral weight**,
Res. Number Theory 4 (2018), no. 4, Art. 45, 21 pp. [\[arxiv\]](#)
- **Polynomial partition asymptotics**, (with N. Robles)
J. Math. Anal. Appl. 458 (2018), no. 1, 359-384. [\[arxiv\]](#)

Teaching at Caltech

List of previous classes of which I have been the sole instructor.

Instructors are given a rating on a 5.0 scale by their students.

Spring 2023	Ma162a Topics in number theory (6 students)
Fall 2022	Ma160a Algebraic number theory (4 students, 4.5)
Spring 2022	Ma191c Spectrum of hyperbolic surfaces and number theory (5 students, 4.6)
Fall 2021	Ma108a Classical analysis (34 students, 4.5)
	Ma160a Algebraic number theory (4 students, 5.0)
Spring 2021	Ma160c Analytic number theory (1 student reading class, not surveyed)
Fall 2020	Ma108a Classical analysis (40 students, 4.4).

Mentorship at Caltech

I have mentored the following undergraduate students in the SURF program at Caltech (Summer Undergraduate Research Fellowships).

Summer 2022	Kenji Nakagawa and Necef Kavrut
Summer 2021	Justin Toyota.

Service at Caltech

Winter 2020/21/22	Graduate admissions application reviewer
Fall 2021- Spr 2023	Caltech number theory seminar co-organiser
Spring 2022	PhD defence committee member for Alexandre Perozim de Faveri
Spring 2021	PhD defence committee member for Andrei Shubin
	PhD candidacy committee member for Alexandre Perozim de Faveri

Teaching at Illinois

Each graduate teaching assignment consisted of teaching two discussion sections (≈ 60 students total per semester).

Graduate TAs are given a rating on a 5.0 scale by their students.

Fall 2017	Math 241 Calc 3 TA (Ranked as Outstanding, 4.8 and 4.8)
Spring 2017	Math 241 Calc 3 TA (Ranked as Excellent, 4.5 and 4.7)
Fall 2016	Math 241 Calc 3 TA (Ranked as Excellent, 4.4 and 4.7)
Summer 2016	Netmath TA
Fall 2015	Math 241 Calc 3 TA (Ranked as Excellent, 4.2 and 4.7)

Invited talks (reverse chronological)

May 2023	Bias in cubic Gauss sums: Patterson's conjecture , Number theory and algebra seminar, Brown University
Apr 2023	Bias in cubic Gauss sums: Patterson's conjecture , Number theory seminar, Claremont Colleges
Mar 2023	Bias in cubic Gauss sums: Patterson's conjecture , Columbia-CUNY-NYU Number theory seminar
Dec 2022	Bias in cubic Gauss sums: Patterson's conjecture , TU Darmstadt
Nov 2022	Bias in cubic Gauss sums: Patterson's conjecture , AIM FRG Seminar
Nov 2022	Bias in cubic Gauss sums: Patterson's conjecture , Number Theory Seminar, University of Virginia
Nov 2022	Bias in cubic Gauss sums: Patterson's conjecture , Number Theory Seminar, Kansas State University

- Nov 2022 **Bias in cubic Gauss sums: Patterson's conjecture**,
Number Theory Seminar, Rutgers University
- Nov 2022 **Bias in cubic Gauss sums: Patterson's conjecture**,
Number Theory Seminar, University of Mississippi
- Sept 2022 **Bias in cubic Gauss sums: Patterson's conjecture**,
Plenary speaker, Number Theory Down Under,
University of Queensland, Australia
- Feb 2022 **Bias in cubic Gauss sums: Patterson's conjecture**,
Number Theory Seminar, U.Illinois at Urbana-Champaign
- Feb 2022 **Bias in cubic Gauss sums: Patterson's conjecture**,
Number Theory Seminar, UC Irvine
- Feb 2022 **Bias in cubic Gauss sums: Patterson's conjecture**,
Number Theory Seminar, UCLA
- Dec 2021 **Bias in cubic Gauss sums: Patterson's conjecture**,
Number Theory Seminar, Gottingen University
- Dec 2021 **Bias in cubic Gauss sums: Patterson's conjecture**,
Special session on "Arithmetic statistics",
Canadian Mathematical Society
- Oct 2021 **Bias in cubic Gauss sums: Patterson's conjecture**,
Joint Berkeley-Caltech-Stanford Number Theory Seminar
- May 2021 **Moments of half integral weight modular L -functions,
bilinear forms and applications**,
Number Theory Seminar, University of Virginia
- Apr 2021 **Maass forms and the mock theta function $f(q)$** ,
Number Theory Seminar, Caltech
- Jan 2021 **Maass forms and the mock theta function $f(q)$** ,
Institut Mittag-Leffler, Sweden
- Jan 2020 **Moments of half integral weight modular L -functions,
bilinear forms and applications**,
Number Theory Seminar, Vanderbilt University
- Jan 2020 **Moments of half integral weight modular L -functions,
bilinear forms and applications**,
Number Theory Seminar, Texas A & M University
- Jan 2020 **Moments of half integral weight modular L -functions,
bilinear forms and applications**,
Number Theory Seminar, Caltech
- Jan 2020 **Maass forms and the mock theta function $f(q)$** ,
AMS Special Session on "Interactions Among Partitions,
Basic Hypergeometric Series and Modular Forms", JMM, Denver
- Nov 2019 **Moments of half integral weight modular L -functions,
bilinear forms and applications**,
Algebra and Number Theory Seminar, Brown University
- Nov 2019 **Maass forms and the mock theta function $f(q)$** ,
AMS Special Session on "Partition Theory and Related Topics",
AMS Sectional Meeting, Gainesville, Florida
- Sept 2019 **Moments of half integral weight modular L -functions,
bilinear forms and applications**,
Number Theory Seminar, Duke University
- Sept 2019 **Twisted second moment of half integral weight modular L -functions**,
PANTS XXXII, UNC, Charlotte
- Sept 2019 **Twisted second moment of half integral weight modular L -functions**,
Number Theory Seminar, U.Illinois at Urbana-Champaign
- June 2019 **Twisted second moment of half integral weight modular L -functions**,
Analytic and Combinatorial Number Theory:
The Legacy of Ramanujan, U.Illinois at Urbana-Champaign
- April 2019 **Maass forms and the mock theta function $f(q)$** ,
Plenary graduate student lecture, SERMON, UNC, Greensboro

- March 2019 **Maass forms and the mock theta function $f(q)$,**
Pure Maths Seminar, U.Melbourne, Australia
- March 2019 **Maass forms and the mock theta function $f(q)$,**
Pure Maths Seminar, U.New South Wales, Australia
- March 2019 **Maass forms and the mock theta function $f(q)$,**
Pure Maths Seminar, U.Queensland, Australia
- June 2018 **Maass forms and the mock theta function $f(q)$,**
Combinatory Analysis 2018, A Conference in Honor of
George Andrews' 80th Birthday, Pennsylvania State University
- April 2018 **Partition asymptotics and the polylogarithm,**
Philadelphia Area Number Theory Seminar, Bryn Mawr College
- March 2018 **Kloosterman sums attached to the Dedekind eta multiplier,**
32nd Automorphic Forms Workshop, Tufts University, Boston
- Oct 2017 **Partition asymptotics and the polylogarithm,**
Pure Maths Seminar, U.Queensland, Australia
- Oct 2017 **Partition asymptotics and the polylogarithm,**
Number Theory Down Under, La Trobe University, Australia
This won the prize for the *Best Student Talk*
- Sept 2017 **Partition asymptotics and the polylogarithm,**
Number Theory Seminar, U.Illinois at Urbana-Champaign

Professional service

Referee for: J. Number Theory, Acta Arithmetica, J. Mathematical Analysis and its Applications, Discrete Analysis.