

ALEXANDER J. DUNN

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Research interests

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

Employment

September 2020– **California Institute of Technology (Caltech), USA**
Olga Taussky & John Todd Instructor (postdoc) in Mathematics
Mentor: Professor Maksym Radziwiłł

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)
Advisors: Professors Ole Warnaar and Wadim Zudilin
- 2013 **University of Queensland, Australia**
Bachelor of Science Honours I, awarded with a University Medal

Awards and honours

- 2021 Mittag-Leffler Junior Fellowship, Sweden
2020 Bateman Prize in Number Theory, UIUC
2020 Bateman Fellowship in Number Theory, UIUC
2019 Plenary student speaker at *Southeast Regional Meeting on Numbers*
2018 UIUC Campus Research Board Grant (with Scott Ahlgren)
2013 University Medal, U.Queensland
2013 The Ethel Raybould Prize in Mathematics, U.Queensland
2013 Australian Postgraduate Award
2013 Valedictorian, Faculty of Science, U.Queensland
2011 The Maude Walker Prize, Faculty of Science, U.Queensland
2010 UQ Excellence Scholarship

Papers and preprints

- **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. [\[arxiv\]](#)

Previous invited talks (reverse chronological)

- 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 $f(q)$**
Mittag-Leffler Institute, 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, Penn State
- 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

Teaching at Caltech

List of previous/current classes of which I have been/am the sole instructor.
Instructors are given a rating on a 5.0 scale by their students.

- Spring 2022 (current): Ma191c instructor (Special topics, TBA)
- Fall 2021: Ma108a instructor (Classical analysis, 34 students, 4.5)
- Fall 2021: Ma160a instructor (Algebraic number theory, 4 students, 5.0)
- Spring 2021: Ma160c instructor (Multiplicative/analytic number theory, 1 student, unrated)
- Fall 2020: Ma108a instructor (Classical analysis, 40 students, 4.4)

Service and mentorship at Caltech

- Fall 2021/Winter 2022: Caltech number theory seminar organiser
- Summer 2021: Mentor to undergraduate Justin Toyota in the SURF program
(Summer Undergraduate Research Fellowships)
Project: *Partition asymptotics and the generalised Von Mangoldt function.*
- Spring 2021: PhD defence committee member for Andrei Shubin
- Spring 2021: PhD candidacy committee member for Alexandre Perozim de Faveri
- Winter 2020/2021: Graduate admissions application reviewer

Teaching at Illinois

Each teaching assignment consisted of teaching two discussion sections (≈ 60 students total).
Instructors are given a rating on a 5.0 scale by their students.

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

Professional service

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