Jonathan Leake

Technische Universität, Berlin

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Interests in combinatorics, polynomials, log-concavity, and entropy—especially analytic questions concerning linear operators and log-concave polynomials, discrete approximation via continuous optimization techniques, and applications to computer science.

Education

- **UC Berkeley** — **Berkeley, CA**
  PhD Mathematics, advised by Olga Holtz — *2014–2019*
  Dissertation: Analytic and Combinatorial Features of Stable Polynomials
- **Texas A&M University** — **College Station, TX**
  MS Mathematics, advised by Roger Smith — *2010–2012*
- **Texas A&M University** — **College Station, TX**
  BS Applied Mathematics and Computer Engineering — *2006–2010*
  Summa Cum Laude with University Honors

Positions Held

- **TU Berlin** — **Berlin, Germany**
  Dirichlet Postdoc Fellowship, under Peter Bürgisser — *2020–2022*
- **Institut Mittag-Leffler** — **Stockholm, Sweden**
  Postdoc Fellowship, Algebraic and Enumerative Combinatorics — *Spring 2020*
- **KTH** — **Stockholm, Sweden**
  Postdoc, under Petter Brändén — *2019–2020*

Awards

- **James H. Simons Fellowship** — **Berkeley, CA**
  Simons Institute — *Spring 2019*

Publications

- **Lorentzian polynomials on cones and the Heron-Rota-Welsh conjecture** (with P. Brändén), preprint (2021). [arXiv]
- **Lower Bounds for Contingency Tables via Lorentzian Polynomials** (with P. Brändén and I. Pak), *Israel Journal of Mathematics* (to appear). [arXiv]
- **A Representation Theoretic Interpretation of the Borcea-Brändén Characterization**, *Mathematische Zeitschrift* (2021). [arXiv]
- **Capacity Lower Bounds via Productization** (with L. Gurvits), *STOC 2021*. [arXiv]
- **Sampling Matrices from Harish-Chandra–Itzykson–Zuber Densities with Applications to Quantum Inference and Differential Privacy** (with C. McSwiggen and N. Vishnoi), *STOC 2021*. [arXiv]
- **Counting Matchings via Capacity Preserving Operators** (with L. Gurvits), *Combinatorics, Probability, and Computing* (2021). [arXiv]
- **Connecting the q-Multiplicative Convolution and the Finite Difference Convolution** (with N. Ryder), *Advances in Mathematics* (2020). [arXiv]

- **On the Computability of Continuous Maximum Entropy Distributions: Adjoint Orbits of Lie Groups** (with N. Vishnoi), preprint (2020). [arXiv]
- **On the Computability of Continuous Maximum Entropy Distributions with Applications** (with N. Vishnoi), *STOC 2020*. [arXiv]
- **Mixed Determinants and the Kadison-Singer Problem** (with M. Ravichandran), *Mathematische Annalen* (2020). [PDF]
- **Generalizations of the Matching Polynomial to the Multivariate Independence Polynomial** (with N. Ryder), *Algebraic Combinatorics* (2019). [PDF]
- **On the Further Structure of the Finite Free Convolutions** (with N. Ryder), preprint (2018). [arXiv]

Invited Talks

- **University of Washington** — **Seattle, WA**
  Combinatorics and Geometry Seminar — *October 2021*
  Title: *Lorentzian polynomials on cones and the Heron-Rota-Welsh conjecture*
- **Simons Institute, UC Berkeley** — **Berkeley, CA**
  Geometric Methods in Optimization and Sampling Boot Camp — *September 2021*
  Title: *Optimization and Sampling Under Symmetry (Part 2)*
- **TU Braunschweig** — **Braunschweig, Germany**
  Real Algebraic and Convex Geometry Conference — *July 2021*
  Title: *Transportation Polytope Volume Bounds via Lorentzian Polynomials*
- **Max Planck Institute** — **Leipzig, Germany**
  Polytopics — *April 2021*
  Title: *Flow/Transportation Polytope Volume Bounds via Polynomial Capacity*
- **Simons Institute, UC Berkeley** — **Berkeley, CA**
  Geometry of Polynomials Reunion — *September 2020*
  Title: *Capacity Bounds via Productization*
- **Institut Mittag-Leffler** — **Stockholm, Sweden**
  Unimodality, Log-concavity, and Beyond — *March 2020*
  Title: *Approximate Counting via Polynomial Capacity*
- **Simons Institute, UC Berkeley** — **Berkeley, CA**
  Deterministic Counting, Probability, and Zeros of Partition Functions — *March 2019*
  Title: *Counting Matchings via the Capacity Method*
- **Simons Institute, UC Berkeley** — **Berkeley, CA**
  Beyond Randomized Rounding and the Probabilistic Method — *February 2019*
  Title: *On the Further Structure of Finite Free Convolutions*
- **Institut Mittag-Leffler** — **Stockholm, Sweden**
  Hausdorff Geometry of Polynomials and Polynomial Sequences — *May 2018*
  Title: *Capacity Preserving Operators*
- **IPAM, UCLA** — **Los Angeles, CA**
  Expected Characteristic Polynomial Techniques and Applications — *April 2018*
  Title: *Extending the Borcea-Brändén Characterization*

Teaching Experience

- **TU Berlin** — **Berlin, Germany**
  Lecturer, Polynomial Capacity: Theory, Applications, Generalizations — *2020–2021*
- **UC Berkeley** — **Berkeley, CA**
  Graduate Student Instructor, Calculus and Discrete Mathematics — *2014–2017*

- **Texas A&M University** — **College Station, TX**
  Teaching Assistant, Calculus — *2010–2012*

Research Visits

- **Boğaziçi University** — **Istanbul, Turkey**
  Invited by Mohan Ravichandran — *June 2018, 1 week*

Other Talks

- **KTH** — **Stockholm, Sweden**
  Title: *Transportation polytope volume bounds* — *May 2021*
- **TU Berlin** — **Berlin, Germany**
  Title: *Log-concavity and Entropy via Polynomial Capacity* — *October 2020*
- **Institut Mittag-Leffler** — **Stockholm, Sweden**
  Title: *Log-concavity of Independence Sets of Claw-free Graphs* — *March 2020*
- **Boğaziçi University** — **Istanbul, Turkey**
  Title: *History and Applications of Stability Preservers* — *June 2018*
- **UC Berkeley** — **Berkeley, CA**
  Student Discrete Analysis Seminar, run by Nikhil Srivastava — *2017–2019*
  Numerous talks given

Outside Employment

- **Texas Teachers' Public Pension Fund** — **Austin, TX**
  Part-time Developer — *2012–2014, 2017–2019*
- **Dell** — **Round Rock, TX**
  Intern, Developer — *Summer 2008*