

Anton Bernshteyn

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RESEARCH INTERESTS

My main areas of research are **combinatorics** and **descriptive set theory**. Some particular topics I am interested in include: graph coloring, probabilistic methods, extremal combinatorics, and Borel/measurable combinatorics with applications to ergodic theory.

EDUCATION

PHD in Mathematics, **University of Illinois at Urbana–Champaign**, Urbana, IL, U.S.A., 2018

- Advisors: [Alexandr Kostochka](#) and [Anush Tserunyan](#)
- Thesis: [Coloring Problems in Combinatorics and Descriptive Set Theory](#)

MSC in Mathematics, **University of Illinois at Urbana–Champaign**, Urbana, IL, U.S.A., 2016

BSC in Mathematics, **Novosibirsk State University**, Novosibirsk, Russia, 2014

ACADEMIC APPOINTMENTS

Assistant Professor, **Georgia Institute of Technology**, Atlanta, GA, U.S.A., Aug 2020–present

Postdoctoral Associate, **Carnegie Mellon University**, Pittsburgh, PA, U.S.A., Sep 2018–Jul 2020

GRANTS

NSF Grant DMS-2239187: *CAREER: Developing a unified theory of descriptive combinatorics and local algorithms*, 2023–2028

NSF Grant DMS-2045412: *The Interplay between Combinatorics, Set Theory, and Dynamics*, 2020–2023

AWARDS & FELLOWSHIPS

Philippe Tondeur Dissertation Prize, 2018

Waldemar J., Barbara G., and Juliette Alexandra Trjitzinsky Fellowship, 2017–2018

Illinois Distinguished Fellowship, 2014–2017

PUBLICATIONS & PREPRINTS

Total citations: **180 (MathSciNet)**, **448 (Google Scholar)**

Below ★ or ◦ means that the paper is joint with one or more graduate, resp. undergraduate students.

Preprints (submitted)

(3) ★ With J. ANDERSON and A. DHAWAN. [Coloring graphs with forbidden almost bipartite subgraphs](#).

(2) [Distributed algorithms, the Lovász Local Lemma, and descriptive combinatorics](#).

(1) ◦ With T. BRAZELTON, R. CAO, and A. KANG. [Counting colorings of triangle-free graphs](#).

Journal articles (accepted)

- (33) [Equivariant maps to subshifts whose points have small stabilizers](#). **Journal of Modern Dynamics**, to appear.
- (32) [Probabilistic constructions in continuous combinatorics and a bridge to distributed algorithms](#). **Advances in Mathematics**, to appear.
- (31) ◦ With E. LEE. [Weak degeneracy of graphs](#). **Journal of Graph Theory**, to appear.
- (30) ★ With J. ANDERSON and A. DHAWAN. [Coloring graphs with forbidden bipartite subgraphs](#). **Combinatorics, Probability and Computing**, 32 (1), 2023, 45–67.
- (29) [Descriptive combinatorics and distributed algorithms](#). **Notices of the American Mathematical Society**, Feature Article, 69 (9), 2022, 1496–1507.
- (28) [Borel fractional colorings of Schreier graphs](#). **Annales Henri Lebesgue**, 5, 2022, 1151–1160.
- (27) ◦ With E. LEE. [Searching for an intruder on graphs and their subdivisions](#). **Electronic Journal of Combinatorics**, 29 (3), 2022, P3.9.
- (26) With M. DELCOURT and A. TSERUNYAN. [Independent sets in algebraic hypergraphs](#). **Journal of the European Mathematical Society**, 24 (1), 2022, 1–35.
- (25) [Local coloring problems on smooth graphs](#). **Fundamenta Mathematicae**, 256, 2022, 333–339.
- (24) [A fast distributed algorithm for \$\(\Delta + 1\)\$ -edge-coloring](#). **Journal of Combinatorial Theory, Series B**, 152, 2022, 319–352.
- (23) With C.T. CONLEY. [Equitable colorings of Borel graphs](#). **Forum of Mathematics, Pi**, 9, 2021, E12.
- (22) [On Baire measurable colorings of group actions](#). **Ergodic Theory and Dynamical Systems**, 41 (3), 2021, 818–845.
- (21) [A short proof of Bernoulli disjointness via the Local Lemma](#). **Proceedings of the American Mathematical Society**, 148, 2020, 5235–5240.
- (20) [Ergodic theorems for the shift action and pointwise versions of the Abért–Weiss theorem](#). **Israel Journal of Mathematics**, 235, 2020, 255–293.
- (19) With O. KHORMALI, R.R. MARTIN, J. ROLLIN, D. RORABAUGH, S. SHAN, and A.J. UZZELL. [Regular colorings in regular graphs](#). **Discussiones Mathematicae Graph Theory**, 40 (3), 2020, 795–806.
- (18) With A. KOSTOCHKA and X. ZHU. [Fractional DP-colorings of sparse graphs](#). **Journal of Graph Theory**, 93 (2), 2020, 203–221.
- (17) [Multiplication of weak equivalence classes may be discontinuous](#). **Transactions of the American Mathematical Society**, 372, 2019, 8091–8106.
- (16) [Building large free subshifts using the Local Lemma](#). **Groups, Geometry, and Dynamics**, 13 (4), 2019, 1417–1436.
- (15) With A. KOSTOCHKA. [DP-colorings of hypergraphs](#). **European Journal of Combinatorics**, 78, 2019, 134–146.
- (14) With M. TAIT. [Improved lower bound for difference bases](#). **Journal of Number Theory**, 205, 2019, 50–58.
- (13) [Measurable versions of the Lovász Local Lemma and measurable graph colorings](#). **Advances in Mathematics**, 353, 2019, 153–223.
- (12) [The Johansson–Molloy theorem for DP-coloring](#). **Random Structures and Algorithms**, 54 (4), 2019, 653–664.
- (11) With M. DELCOURT, H. TOWNSNER, and A. TSERUNYAN. [A short nonalgorithmic proof of the containers theorem for hypergraphs](#). **Proceedings of the American Mathematical Society**, 147 (4), 2019, 1739–1749.
- (10) With A. KOSTOCHKA. [Об отличиях DP-раскраски от предписанной раскраски](#) (Russian) [On differences between DP-coloring and list coloring]. **Matematicheskie Trudy**, 21 (2), 2018, 61–71; [English version](#).

- (9) With A. KOSTOCHKA. *Sharp Dirac's theorem for DP-critical graphs*. **Journal of Graph Theory**, 88 (3), 2018, 521–546.
- (8) With A. KOSTOCHKA and X. ZHU. *DP-colorings of graphs with high chromatic number*. **European Journal of Combinatorics**, 65, 2017, 122–129.
- (7) *The Local Cut Lemma*. **European Journal of Combinatorics**, 63 (2017), 95–114.
- (6) With A. KOSTOCHKA and S. PRON. *О DP-раскраске графов и мультиграфов* (Russian) [On DP-coloring of graphs and multigraphs]. **Siberian Mathematical Journal**, 58 (1), 2017, 36–47; [English version](#).
- (5) *The asymptotic behavior of the correspondence chromatic number*. **Discrete Mathematics**, 339 (11), 2016, 2680–2692.
- (4) *New bounds for the acyclic chromatic index*. **Discrete Mathematics**, 339 (10), 2016, 2543–2552.
- (3) With A. KOSTOCHKA. *On the number of edges in a graph with no $(k + 1)$ -connected subgraphs*. **Discrete Mathematics**, 339 (2), 2016, 682–688.
- (2) *3-регулярные подграфы и $(3, 1)$ -раскраски 4-регулярных псевдографов* (Russian) [3-Regular subgraphs and $(3, 1)$ -colorings of 4-regular pseudographs]. **Discrete Analysis and Operations Research**, 21 (5), 2014, 3–16.
- (1) With N. SHILOV. *Мультиагентная задача о роботах в пространстве: сложностной, информационный и криптографический аспекты* (Russian) [Robots in Space Multi-agent Problem: complexity, information and cryptographic aspects]. **Modeling and Analysis of Information Systems**, 20 (2), 2013, 34–53.

Expository writing

- (3) *The \mathbb{G}_0 -dichotomy*.
 - (2) *An ℓ_2 -based proof of Gaboriau's theorem*.
 - (1) *Linear Algebra* (lecture notes).
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MENTORING

Currently advised students

- [James Anderson](#), Ph.D.
- [Abhishek Dhawan](#) (co-advised with [Cheng Mao](#)), Ph.D.
- [Jing Yu](#), Ph.D.

Currently supervised postdocs

- [Evelyne Smith-Roberge](#), 2022–present

Past advised students

- Aaditya Raghavan, B.Sc., 2022
- Eugene Lee, B.Sc./M.Sc., 2022

Other mentoring (REUs, GRAs, etc.)

- C. Chang, H. Fusco, S. Peterson, F. Roth, and H. Simmons, Georgia Tech REU, Summer 2022
 - Manuel Fernandez, GRA, Spring–Summer 2022
 - Tyler Brazelton, Ruijia Cao, and Akum Kang, undergraduate research project, Summer 2021
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INVITED TALKS

Invited conference talks

- (25) *SIU Probability and Statistics Conference*, **Southern Illinois University**, Carbondale, IL, 2022

- (24) *Fall Southeastern Sectional Meeting of the AMS*, Special Session on *Structural and Extremal Graph Theory*, **University of Tennessee at Chattanooga**, Chattanooga, TN, 2022
- (23) Workshop on *Set Theory*, **Erwin Schrödinger International Institute for Mathematics and Physics**, Vienna, Austria, 2022
- (22) Workshop on *Descriptive Graph Theory*, **American Institute of Mathematics**, San Jose, CA, 2022
- (21) *SIAM Conference on Discrete Mathematics*, Special Sessions on *Advances in Structural Graph Theory* and *Probabilistic Methods in Combinatorics*, **Carnegie Mellon University**, Pittsburgh, PA, 2022
- (20) *Spring Western Sectional Meeting of the AMS*, Special Session on *Enumerative and Extremal Problems in Chromatic Graph Theory*, **virtual**, 2022
- (19) *Virtual Mini-conference on Graph Theory & Combinatorics*, **virtual** (formerly at **University of Virginia**), 2022
- (18) *South Eastern Logic Symposium*, **University of Florida**, Gainesville, FL, 2022
- (17) *Descriptive Combinatorics, LOCAL Algorithms, and Random Processes*, **hybrid/Oberwolfach Research Institute for Mathematics**, Oberwolfach, Germany, 2022
- (16) *Groups and Dynamics: Topology, Measure, and Borel Structure*, **hybrid/Oberwolfach Research Institute for Mathematics**, Oberwolfach, Germany, 2022
- (15) *10th Workshop on Advances in Distributed Graph Algorithms (ADGA)*, **virtual/University of Freiburg**, Freiburg, Germany; [video of the talk](#), 2021
- (14) *A Sparse (Graphs) Coalition*, Session 2: *Entropy Compression and Related Methods*, **virtual**, 2021
- (13) *Joint Mathematics Meetings*, ASL Invited Address, **virtual**; [video of the talk](#), 2021
- (12) *CMS Winter Meeting*, Mini-course on *The Lovász Local Lemma and its Applications in Ergodic Theory and Descriptive Set Theory*, **virtual** (formerly at **McGill University**); [video of the mini-course](#), 2020
- (11) *Fall Southeastern Sectional Meeting of the AMS*, Special Session on *Structural and Extremal Graph Theory*, **virtual** (formerly at **University of Tennessee at Chattanooga**), 2020
- (10) *Measurable, Borel, and Topological Dynamics*, **Centre International de Rencontres Mathématiques**, Marseille, France, 2019
- (9) *Waterloo Coloring Conference*, **University of Waterloo**, Waterloo, ON, Canada, 2019
- (8) *Logic Fest in the Windy City*, **University of Illinois at Chicago**, Chicago, IL, 2019
- (7) *Joint Mathematics Meetings (JMM)*, AMS Special Session on *Recent Advances in Regularity Lemmas*, Baltimore, MD, 2019
- (6) *Atlanta Lecture Series in Combinatorics and Graph Theory*, **Emory University**, Atlanta, GA, 2018
- (5) *South Eastern Logic Symposium*, **University of Florida**, Gainesville, FL, 2018
- (4) *Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM)*, Graph Colouring Minisymposium, **Ryerson University**, Toronto, ON, Canada, 2017
- (3) *Spring Central Sectional Meeting of the AMS*, Special Session on *Extremal Problems in Graphs, Hypergraphs and Other Combinatorial Structures*, **Indiana University**, Bloomington, IN, 2017
- (2) *Workshop on New Trends in Graph Coloring*, **Banff International Research Station**, Banff, AB, Canada; [video of the talk](#), 2016
- (1) *Atlanta Lecture Series in Combinatorics and Graph Theory*, **Georgia State University**, Atlanta, GA, 2016

Invited seminar talks

- (46) Mathematics Colloquium, **University of Central Florida**, Orlando, FL, Dec 2, 2022
- (45) Applied Mathematics Colloquium, **Illinois Institute of Technology**, Chicago, IL, Oct 31, 2022
- (44) Joint Logic/Combinatorics Seminar, **University of Florida**, Gainesville, FL, Oct 18, 2022
- (43) Mathematics Colloquium, **University of Florida**, Gainesville, FL, Oct 17, 2022

- (42) Algebra and Combinatorics Seminar, **Texas A&M University**, College Station, TX, Apr 22, 2022
- (41) Discrete Applied Math Seminar, **Illinois Institute of Technology**, Chicago, IL, Apr 8, 2022
- (40) ISU Discrete Math Seminar, **Iowa State University**, Ames, IA, Apr 5, 2022
- (39) Discrete Math Seminar, **Emory University**, Atlanta, GA, Mar 16, 2022
- (38) Logic Seminar, **Cornell University**, Ithaca, NY, Feb 18, 2022
- (37) Oliver Club (Department of Mathematics Colloquium), **Cornell University**, Ithaca, NY, Feb 17, 2022
- (36) UCSD Combinatorics Seminar, **University of California, San Diego**, San Diego, CA, Nov 23, 2021
- (35) Discrete/Combinatorics Seminar, **University of South Carolina**, Columbia, SC, Oct 22, 2021
- (34) UCSD Group Actions Seminar, **University of California, San Diego**, San Diego, CA, Oct 14, 2021
- (33) Aalto CS Theory Seminar, **Aalto University**, Espoo, Finland, May 19, 2021
- (32) CMU Math Club, **Carnegie Mellon University**, Pittsburgh, PA, Apr 28, 2021
- (31) Graphs at Ryerson, **Ryerson University**, Toronto, ON, Apr 13, 2021
- (30) Discrete Math Seminar, **Illinois State University**, Normal, IL, Apr 1, 2021
- (29) Descriptive Dynamics and Combinatorics Seminar, **McGill University**, Montreal, QC, Mar 24, 2021
- (28) Discrete Math Seminar, **Iowa State University**, Ames, IA, Mar 18, 2021
- (27) Combinatorics and Probability Seminar, **Ohio State University**, Columbus, OH, Mar 4, 2021
- (26) Combinatorics Seminar, **University of Warwick**, Coventry, United Kingdom, Nov 27, 2020
- (25) Theoretical CS Seminar, **Dartmouth College**, Hanover, NH, Oct 23; [video of the talk](#), 2020
- (24) Summer Seminar in Combinatorics, **Novosibirsk State University**, Novosibirsk, Russia, Aug 12, 2020
- (23) Extremal & Probabilistic Combinatorics Webinar, Jun 29; [video of the talk](#), 2020
- (22) Descriptive Set Theory Seminar, **University of Illinois at Urbana–Champaign**, Urbana, IL, Apr 29, 2020
- (21) Cornell Logic Seminar, **Cornell University**, Ithaca, NY, Apr 28, 2020
- (20) Caltech–UCLA Logic Seminar, **California Institute of Technology**, Pasadena, CA, Apr 17, 2020
- (19) Job Candidate Talk, **Georgia Institute of Technology**, Atlanta, GA, Feb 18, 2020
- (18) Combinatorics & Optimization Seminar, **University of Waterloo**, Waterloo, ON, Canada, Jan 13, 2020
- (17) Special Colloquium, **University of Illinois at Chicago**, Chicago, IL, Dec 4, 2019
- (16) Descriptive Set Theory Seminar, **University of Illinois at Urbana–Champaign**, Urbana, IL, Apr 10, 2019
- (15) Graph Theory & Combinatorics Seminar, **University of Illinois at Urbana–Champaign**, Urbana, IL, Apr 9, 2019
- (14) Logic Seminar, **University of Illinois at Urbana–Champaign**, Urbana, IL, Apr 9, 2019
- (13) Tutte Colloquium, **University of Waterloo**, Waterloo, ON, Canada, Mar 8, 2019
- (12) Model Theory Seminar, **University of Waterloo**, Waterloo, ON, Canada, Mar 7, 2019
- (11) Graphs and Matroids Seminar, **University of Waterloo**, Waterloo, ON, Canada, Mar 6, 2019
- (10) Groups and Dynamics Seminar, **Texas A&M University**, College Station, TX, Nov 14, 2018
- (9) Combinatorics Seminar, **University of Birmingham**, Birmingham, United Kingdom, May 30, 2018
- (8) Mathematics Colloquium, **Western Illinois University**, Macomb, IL, Apr 26, 2018
- (7) Discrete Applied Math Seminar, **Illinois Institute of Technology**, Chicago, IL, Feb 7, 2018
- (6) Logic Seminar, **University of Illinois at Chicago**, Chicago, IL, Apr 11, 2017
- (5) Combinatorics Seminar, **University of Birmingham**, Birmingham, United Kingdom, Feb 16, 2017
- (4) DIMAP Seminar, **University of Warwick**, Coventry, United Kingdom, Feb 14, 2017
- (3) Caltech–UCLA Logic Seminar, **University of California, Los Angeles**, CA, Nov 18, 2016
- (2) Logic Seminar, **California Institute of Technology**, Pasadena, CA, Nov 17, 2016

(1) Mathematical Logic Seminar, **Carnegie Mellon University**, Pittsburgh, PA, Oct 11, 2016

TEACHING

Georgia Institute of Technology

2023 Spring: **Probabilistic Combinatorics** (MATH 7018).

2022 Fall: **Applied Combinatorics** (MATH 3012) and **Introduction to Graph Theory** (MATH 4022).
Spring: **Probabilistic Combinatorics** (MATH 7018) and **Undergraduate Research** (MATH 4699).

2021 Fall: **Descriptive Combinatorics** (MATH 8803) and **Undergraduate Research** (MATH 2699/4699).
Summer: **Undergraduate Research** (MATH 2699/4699).

Spring: **Combinatorial Analysis** (MATH 4032) and **Special Problems** (MATH 8900).

2020 Fall: **Introduction to Graph Theory** (MATH 4022).

Carnegie Mellon University

2019 Fall: **Combinatorics** (21-301) and **Algebraic Structures** (21-373).

Summer: **Research Topics in Combinatorics** (21-499).

Spring: **Set Theory** (21-329).

2018 Fall: **Linear Algebra** (21-341).

University of Illinois at Urbana–Champaign

2018 Spring: **Set Theory and Forcing** (graduate, MATH 574), TA.

2017 Fall: **A Mathematical World** (MATH 181), primary instructor (with curriculum responsibilities).
Spring: **Real Analysis** (graduate, MATH 540), TA.

2016 Fall: **Combinatorial Mathematics** (graduate, MATH 580), TA, and **Structure of Graphs** (graduate, MATH 582), TA.

Spring: **Mathematical Logic** (MATH 414), TA, and **Linear Programming** (MATH 482), TA.

2015 Fall: **Graph Theory** (MATH 412), TA, and **Mathematical Logic** (graduate, MATH 570), TA.

Spring: **Applied Linear Algebra** (MATH 415), TA. On [List of Teachers Ranked as Excellent by Their Students](#).

2014 Fall: **Applied Linear Algebra** (MATH 415), TA. On [List of Teachers Ranked as Excellent by Their Students](#).

SERVICE

Organization of conferences, seminars, etc.

Co-creator and co-organizer of the [Atlanta Combinatorics Colloquium](#), 2022–present.

Co-organizer of the [Georgia Tech Working Seminar in Graph Theory](#), 2022–present.

Creator and organizer of the Georgia Tech Intro to Descriptive Set Theory Seminar, 2021–present.

Co-organizer of the [Georgia Tech Combinatorics Seminar](#), 2021–present.

Co-organizer of the [Georgia Tech Graph Theory Seminar](#), 2020–present.

Serving on the Georgia Tech School of Mathematics Colloquium Committee, 2020–2021.

Organizer of the CMU [Algorithms, Combinatorics, and Optimization Seminar](#), 2019–2020.

Online resources

Maintaining the [Georgia Tech ACO YouTube channel](#), 2020–present.

Creator of the [Logic Talks Online](#) calendar and mailing list, 2020–2022.

Reviews & refereeing

ACM-SIAM Symposium on Discrete Algorithms (SODA)

Annales Henri Lebesgue

Archive for Mathematical Logic

Canadian Mathematical Bulletin

Combinatorica

Discrete Applied Mathematics

Discrete Mathematics

Discussiones Mathematicae Graph Theory

Electronic Journal of Combinatorics

European Journal of Combinatorics

Groups, Geometry, and Dynamics

Innovations in Theoretical Computer Science (ITCS)

Journal of Combinatorial Theory, A

Journal of Combinatorial Theory, B

Journal of Graph Theory

Mathematical Reviews

Memoirs of the AMS

Order

Random Structures & Algorithms

SIAM Journal on Discrete Mathematics