

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., 2020–present

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

GRANTS

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

Preprints (submitted)

With J. ANDERSON and A. DHAWAN. *[Coloring graphs with forbidden bipartite subgraphs. Equivariant maps to subshifts whose points have small stabilizers.](#)*

[Borel fractional colorings of Schreier graphs.](#)

With E. LEE. *[Searching for an intruder on graphs and their subdivisions.](#)*

[Probabilistic constructions in continuous combinatorics and a bridge to distributed algorithms.](#)

[A fast distributed algorithm for \$\(\Delta + 1\)\$ -edge-coloring.](#)

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

With C.T. CONLEY. [Equitable colorings of Borel graphs.](#)

Journal articles

2021+ [Local coloring problems on smooth graphs.](#) **Fundamenta Mathematicae**, to appear.

With M. DELCOURT and A. TSERUNYAN. [Independent sets in algebraic hypergraphs.](#) **Journal of the European Mathematical Society**, to appear.

2021 [On Baire measurable colorings of group actions.](#) **Ergodic Theory and Dynamical Systems**, 41 (3), 2021, 818–845.

2020 [A short proof of Bernoulli disjointness via the Local Lemma.](#) **Proceedings of the American Mathematical Society**, 148, 2020, 5235–5240.

[Ergodic theorems for the shift action and pointwise versions of the Abért–Weiss theorem.](#) **Israel Journal of Mathematics**, 235, 2020, 255–293.

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.

With A. KOSTOCHKA and X. ZHU. [Fractional DP-colorings of sparse graphs.](#) **Journal of Graph Theory**, 93 (2), 2020, 203–221.

2019 [Multiplication of weak equivalence classes may be discontinuous.](#) **Transactions of the American Mathematical Society**, 372, 2019, 8091–8106.

[Building large free subshifts using the Local Lemma.](#) **Groups, Geometry, and Dynamics**, 13 (4), 2019, 1417–1436.

With A. KOSTOCHKA. [DP-colorings of hypergraphs.](#) **European Journal of Combinatorics**, 78, 2019, 134–146.

With M. TAIT. [Improved lower bound for difference bases.](#) **Journal of Number Theory**, 205, 2019, 50–58.

[Measurable versions of the Lovász Local Lemma and measurable graph colorings.](#) **Advances in Mathematics**, 353, 2019, 153–223.

[The Johansson–Molloy theorem for DP-coloring.](#) **Random Structures and Algorithms**, 54 (4), 2019, 653–664.

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.

2018 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](#).

With A. KOSTOCHKA. [Sharp Dirac’s theorem for DP-critical graphs.](#) **Journal of Graph Theory**, 88 (3), 2018, 521–546.

2017 With A. KOSTOCHKA and X. ZHU. [DP-colorings of graphs with high chromatic number.](#) **European Journal of Combinatorics**, 65, 2017, 122–129.

[The Local Cut Lemma.](#) **European Journal of Combinatorics**, 63 (2017), 95–114.

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](#).

2016 [The asymptotic behavior of the correspondence chromatic number.](#) **Discrete Mathematics**, 339 (11), 2016, 2680–2692.

[New bounds for the acyclic chromatic index.](#) **Discrete Mathematics**, 339 (10), 2016, 2543–2552.

With A. КОСТОЧКА. *On the number of edges in a graph with no $(k + 1)$ -connected subgraphs*. **Discrete Mathematics**, 339 (2), 2016, 682–688.

2014 *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.

2013 With N. ШИЛОВ. *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

The \mathbb{G}_0 -dichotomy.

An ℓ_2 -based proof of Gaboriau's theorem.

Linear Algebra (lecture notes).

INVITED TALKS

Invited conference talks

2021 *A Sparse (Graphs) Coalition, Session 2: Entropy Compression and Related Methods*, **virtual**. *Joint Mathematics Meetings*, ASL Invited Address, **virtual**; [video of the talk](#).

2020 *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](#). *Fall Southeastern Sectional Meeting of the AMS, Special Session on Structural and Extremal Graph Theory*, **virtual** (formerly at **University of Tennessee at Chattanooga**).

2019 *Measurable, Borel, and Topological Dynamics*, **Centre International de Rencontres Mathématiques**, Marseille, France.

Waterloo Coloring Conference, **University of Waterloo**, Waterloo, ON, Canada.

Logic Fest in the Windy City, **University of Illinois at Chicago**, Chicago, IL.

Joint Mathematics Meetings (JMM), AMS Special Session on Recent Advances in Regularity Lemmas, Baltimore, MD.

2018 *Atlanta Lecture Series in Combinatorics and Graph Theory*, **Emory University**, Atlanta, GA.

South Eastern Logic Symposium, **University of Florida**, Gainesville, FL.

2017 *Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM)*, Graph Colouring Minisymposium, **Ryerson University**, Toronto, ON, Canada.

Spring Central Sectional Meeting of the AMS, Special Session on Extremal Problems in Graphs, Hypergraphs and Other Combinatorial Structures, **Indiana University**, Bloomington, IN.

2016 *Workshop on New Trends in Graph Coloring*, **Banff International Research Station**, Banff, AB, Canada; [video of the talk](#).

Atlanta Lecture Series in Combinatorics and Graph Theory, **Georgia State University**, Atlanta, GA.

Invited seminar talks

2021 Aalto CS Theory Seminar, **Aalto University**, Espoo, Finland, May 19.

CMU Math Club, **Carnegie Mellon University**, Pittsburgh, PA, Apr 28.

Graphs at Ryerson, **Ryerson University**, Toronto, ON, Apr 13.

Discrete Math Seminar, **Illinois State University**, Normal, IL, Apr 1.
Descriptive Dynamics and Combinatorics Seminar, **McGill University**, Montreal, QC, Mar 24.
Discrete Math Seminar, **Iowa State University**, Ames, IA, Mar 18.
Combinatorics and Probability Seminar, **Ohio State University**, Columbus, OH, Mar 4.

2020 Combinatorics Seminar, **University of Warwick**, Coventry, United Kingdom, Nov 27.
Theoretical CS Seminar, **Dartmouth College**, Hanover, NH, Oct 23; [video of the talk](#).
Summer Seminar in Combinatorics, **Novosibirsk State University**, Novosibirsk, Russia, Aug 12.
Extremal & Probabilistic Combinatorics Webinar, Jun 29; [video of the talk](#).
Descriptive Set Theory Seminar, **University of Illinois at Urbana–Champaign**, Urbana, IL, Apr 29.
Cornell Logic Seminar, **Cornell University**, Ithaca, NY, Apr 28.
Caltech–UCLA Logic Seminar, **California Institute of Technology**, Pasadena, CA, Apr 17.
Job Candidate Talk, **Georgia Institute of Technology**, Atlanta, GA, Feb 18.
Combinatorics & Optimization Seminar, **University of Waterloo**, Waterloo, ON, Canada, Jan 13.

2019 Special Colloquium, **University of Illinois at Chicago**, Chicago, IL, Dec 4.
Descriptive Set Theory Seminar, **University of Illinois at Urbana–Champaign**, Urbana, IL, Apr 10.
Graph Theory & Combinatorics Seminar, **University of Illinois at Urbana–Champaign**, Urbana, IL, Apr 9.
Logic Seminar, **University of Illinois at Urbana–Champaign**, Urbana, IL, Apr 9.
Tutte Colloquium, **University of Waterloo**, Waterloo, ON, Canada, Mar 8.
Model Theory Seminar, **University of Waterloo**, Waterloo, ON, Canada, Mar 7.
Graphs and Matroids Seminar, **University of Waterloo**, Waterloo, ON, Canada, Mar 6.

2018 Groups and Dynamics Seminar, **Texas A&M University**, College Station, TX, Nov 14.
Combinatorics Seminar, **University of Birmingham**, Birmingham, United Kingdom, May 30.
Mathematics Colloquium, **Western Illinois University**, Macomb, IL, Apr 26.
Discrete Applied Math Seminar, **Illinois Institute of Technology**, Chicago, IL, Feb 7.

2017 Logic Seminar, **University of Illinois at Chicago**, Chicago, IL, Apr 11.
Combinatorics Seminar, **University of Birmingham**, Birmingham, United Kingdom, Feb 16.
DIMAP Seminar, **University of Warwick**, Coventry, United Kingdom, Feb 14.

2016 Caltech–UCLA Logic Seminar, **University of California, Los Angeles**, CA, Nov 18.
Logic Seminar, **California Institute of Technology**, Pasadena, CA, Nov 17.
Mathematical Logic Seminar, **Carnegie Mellon University**, Pittsburgh, PA, Oct 11.

MENTORING

Current Ph.D. Students

- [James Anderson](#)
- [Abhishek Dhawan](#)
- [Jing Yu](#)

TEACHING

Georgia Institute of Technology

2021 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-organizer (with Zhiyu Wang and Xingxing Yu) of the [Georgia Tech Graph Theory Seminar](#), 2020–present.

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

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

Reviews & refereeing

Annales Henri Lebesgue (ENS Rennes)

Archive for Mathematical Logic (Springer)

Canadian Mathematical Bulletin (CMS)

Combinatorica (Springer)

Discrete Applied Mathematics (Elsevier)

Discrete Mathematics (Elsevier)

Discussiones Mathematicae Graph Theory (University of Zielona Góra)

Electronic Journal of Combinatorics

European Journal of Combinatorics (Elsevier)

Groups, Geometry, and Dynamics (EMS)

Journal of Combinatorial Theory, A (Elsevier)

Journal of Combinatorial Theory, B (Elsevier)

Journal of Graph Theory (Wiley)

Mathematical Reviews (AMS)

Memoirs of the AMS

Order (Springer)

Random Structures & Algorithms (Wiley)

SIAM Journal on Discrete Mathematics