

Ian L. Charlesworth

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Employment/Education

NSF Postdoctoral Scholar, University of California, Berkeley.	2018-Present
S.E.W. Visiting Assistant Professor, University of California, San Diego.	2017-2018
Ph.D. in Mathematics, University of California, Los Angeles.	2017
B.Math. Honours Pure Mathematics & Honours Computer Science, University of Waterloo.	2012

Research Interests

Free probability, von Neumann algebras

Publications

Journal Articles

- I. Charlesworth and P. Skoufranis. *Analogues of Entropy in Bi-Free Probability Theory: Non-Microstate*, *Advances in Mathematics* **375** (2020), 107367
- I. Charlesworth, K. Dykema, F. Sukochev, and D. Zanin. *Simultaneous upper triangular forms for commuting operators in a finite von Neumann algebra*, *Canadian Journal of Mathematics* **72** (2020), no. 5, 1188-1245.
- I. Charlesworth. *An alternating moment condition for bi-freeness*, *Advances in Mathematics* **346** (2019), 546-568.
- I. Charlesworth and D. Shlyakhtenko. *Free Entropy Dimension and Regularity of Non-commutative Polynomials*, *Journal of Functional Analysis* **271** (2016), no. 8, 2274-2292.
- I. Charlesworth, B. Nelson, and P. Skoufranis. *Combinatorics of Bi-Freeness with Amalgamation*, *Communications in Mathematical Physics* **338** (2015), 801-847.
- I. Charlesworth, B. Nelson, and P. Skoufranis. *On Two-faced Families of Non-commutative Random Variables*, *Canadian Journal of Mathematics* **67** (2015), no. 6, 1290-1325.

Conference Proceedings

- A. Nica, I. Charlesworth, and M. Panju. *Analyzing Query Optimization Process: Portraits of Join Enumeration Algorithms*. IEEE 28th International Conference on Data Engineering (2012).

Preprints

M. Bischoff, I. Charlesworth, S. Evington, L. Giorgetti, and D. Penneys. *Distortion for multifactor bimodules and representations of multifusion categories*. arXiv preprint 2010.01067 (2020).

I. Charlesworth and B. Collins. *Matrix models for ε -free independence*. arXiv preprint 1910.04343 (2019).

I. Charlesworth and P. Skoufranis. *Analogues of Entropy in Bi-Free Probability Theory: Microstates*. arXiv preprint 1902.03874 (2019).

I. Charlesworth and B. Nelson. *Free Stein discrepancy as a regularity condition*. arXiv preprint 1902.02379 (2019); to appear in the Journal of Operator Theory.

Patents

A. Nica and I. Charlesworth. *Highly adaptable query optimizer search space generation process*. U.S. Patent no. 8,429,151 (2013).

Grants

Co-PI for NSF DMS Grant 2000335 (*Young Mathematicians in C^* -Algebras*); 2020; 31,454 USD; with M. Brannan and K. Eifler.

PI for NSF DMS Grant 1803557 (*PostDoctoral Research Fellowship*); 2018-2021; 150,000 USD.

Presentations and Talks

Invited Talks

Distortion for Multifactor Inclusions, Probabilistic Operator Algebras Seminar, University of California, Berkeley, November 2020.

An Introduction to Free Probability, Santa Clara University Colloquium, November 2020.

Free Stein Dimension, IU (Virtual) Analysis Seminar, Indiana University, October 2020.

Free Stein Dimension, Wales MPPM Zoom Seminar, September 2020.

Free Stein Dimension, Seminar in Free Probability and Random Matrices, Queen's University, July 2020.

Free Probability, an expository talk at the Groundwork for Operator Algebras Lecture Series, Michigan State University, July 2020.

Free Stein Irregularity, Real Algebraic Geometry with a View Toward Hyperbolic Programming and Free Probability Workshop, Mathematisches Forschungsinstitut Oberwolfach, March 2020.

Asymptotic ε -independence, Probabilistic Operator Algebras Seminar, University of California, Berkeley, February 2020.

Combinatorics of the bi-free Segal-Bargmann transform, Seminar in Free Probability and Random Matrices, Queen's University, January 2020.

Combinatorics of the bi-free Segal-Bargmann transform, CMS Winter Meeting Session on Operator Algebras, Toronto, December 2019.

Matrix models for ε -independence, AMS Sectional Meeting Special Session on Advances in Operator Algebras, University of California, Riverside, November 2019.

Free Stein irregularity, AMS Sectional Meeting Special Session on Advances in Functional Analysis, University of California, Riverside, November 2019.

Matrix models for ε -independence, 17th East Coast Operator Algebra Symposium, The Ohio State University, October 2019.

Asymptotic ε -independence, Classification Problems in von Neumann Algebras Workshop, Banff International Research Station, October 2019.

Free Stein Irregularity, Analysis Seminar, University of Waterloo, July 2019.

A Stein kernel approach to regularity in free probability, Workshop on Applications to Random Matrices and Free Probability of Free Noncommutative Functions, Fields Institute, University of Toronto, June 2019.

Free Stein Information, Kyoto Operator Algebra Seminar, University of Kyoto/RIMS, May 2019.

Free Stein Information, Operator Theory Seminar, University of Virginia, April 2019.

Free Stein Information, Functional Analysis Seminar, University of California, San Diego, April 2019.

Free Stein Information, Free Probability - the theory, its extensions Workshop, Centre de Recherches Mathématiques, Université de Montréal, March 2019.

Free Stein Information, Southern Ontario Operator Algebras Seminar, Fields Institute, University of Toronto, February 2019.

A Bi-free Segal-Bargmann Transform, AMS Sectional Meeting Special Session on Advances in Operator Theory, Operator Algebras, and Operator Semigroups, San Francisco State University, October 2018.

Infinitesimal bi-free probability, Shanks Workshop: Free Probability and Applications, Vanderbilt University, September 2018.

Fisher information and conjugate variables in bi-free probability theory, Quantum Algebra & Quantum Topology Seminar, The Ohio State University, June 2018.

Non-crossing partitions and the combinatorics of free probability, Noncommutative Geometry Seminar, The Ohio State University, June 2018.

Bi-free probability and an approach to conjugate variables, Probability & Statistics Seminar, University of California, San Diego, May 2018.

Bi-free probability and an approach to conjugate variables, Probability Seminar, University of California, Irvine, February 2018.

Bi-free probability and entropy, CMS Winter Meeting Session on Operator Algebras, University of Waterloo, December 2017.

Bi-free probability and an approach to conjugate variables, Extended Probabilistic Operator Algebras Seminar, University of California, Berkeley, November 2017.

Bi-free probability, vaccine, and entropy, AMS Sectional Meeting Special Session on Advances in Operator Algebras, University of California, Riverside, November 2017.

Combinatorics in Free Probability, Combinatorics Seminar, University of California, San Diego, October 2017.

Bi-free probability, Quantum Symmetries: Subfactors and Planar Algebras, University of Hawai'i Maui College, July 2017.

An alternating moment condition and liberation for bi-freeness, Operator Algebras Seminar, University of California, San Diego, February 2017.

Bi-free probability: a new characterisation and consequences, Joint Mathematics Meetings AMS Special Session on Advances in Operator Algebras, Atlanta, Georgia, January 2017.

An Alternating Moment Condition and Liberation for Bi-freeness, Free Probability Seminar, Queen's University, December 2016.

An Alternating Moment Condition and Liberation for Bi-freeness, Analytic versus Combinatorial in Free Probability Workshop, Banff International Research Station, December 2016.

An Alternating Moment Condition and Liberation for Bi-freeness, Extended Probabilistic Operator Algebras Seminar, University of California, Berkeley, November 2016.

An Alternating Moment Condition for Bi-free Independence, 24th West Coast Operator Algebra Seminar, University of Wyoming, October 2016.

An Alternating Moment Condition for Bi-free Independence, Functional Analysis Seminar, University of California, Los Angeles, October 2016.

Free Entropy and Polynomials, Subfactor Seminar, Vanderbilt University, September 2016.

Regularity in Free Probability, Von Neumann Algebras Trimester Seminar, Hausdorff Research Institute for Mathematics, Universität Bonn, June 2016.

Regularity in Free Probability, Free Probability Seminar, Texas A&M University, April 2016.

Standard invariants of amalgamated Bisch-Haagerup subfactors, AMS Sectional Meeting Special Session on Dynamics, Inverse Semigroups, and Operator Algebras, North Dakota State University, April 2016.

Regularity in Free Probability, Operator Algebras & Related Topics Seminar, University of California, Riverside, April 2016.

Regularity of polynomials in non-commuting random variables, Free Probability and the Large N Limit, V, University of California, Berkeley, March 2016.

Regularity of polynomials in non-commuting random variables, AMS Sectional Meeting Special Session on von Neumann Algebras, University of Memphis, October 2015.

Combinatorics of Bi-free Probability, Extended Probabilistic Operator Algebras Seminar, University of California, Berkeley, May 2015.

Bi-free and Combinatorially Bi-free Random Variables, Probabilistic Operator Algebra Seminar, UC Berkeley, April 2014.

Contributed Talks

Free Stein Dimension, 48th Canadian Operator Symposium, Fields Institute, May 2020.

Free Stein Irregularity, Young Mathematicians in C^* -Algebras, University of Copenhagen, August 2019.

Free Stein Information, Great Plains Operator Theory Symposium, Texas A&M University, May 2019.

Bi-free probability, Great Plains Operator Theory Symposium, Texas Christian University, May 2017.

Regularity and Entropy in Free Probability, Young Mathematicians in C^* -Algebras, University of Münster, July 2016.

Combinatorics of bi-free probability, Free Probability Theory Workshop, Mathematisches Forschungsinstitut Oberwolfach, June 2015.

Honours and Awards

Pacific Journal of Mathematics Dissertation Prize, 2017.

NSERC Postdoctoral Fellowship, 2017 (Declined).

AMS Joint Math Meetings Graduate Student Travel Grant, 2017.

University of California, Los Angeles Dissertation Year Fellowship, 2016.

NSERC PGS D3 Research Scholarship, 2013.

University of Waterloo Faculty of Mathematics Valedictorian, 2012.

NSERC PGS M Research Scholarship, 2012.

NSERC CGS M Research Scholarship, 2012 (Declined).

ACM SIGMOD Undergraduate Research Poster Competition Winner, 2010.

University of Waterloo President's Research Award, 2010.

NSERC USRA Research Scholarship, 2010.

René Descartes Scholarship, University of Waterloo, 2007.

University of Waterloo President's Scholarship of Distinction, 2007.

Canadian Computing Contest Stage 2 Bronze Medalist, University of Waterloo, 2007.

Teaching Experience

University of California, Berkeley, Berkeley, California, USA

Instructor of Record, 2019 - 2020

Math 185 (Introduction to Complex Analysis)

Math 104 (Introduction to Analysis), twice

University of California, San Diego, San Diego, California, USA

Instructor of Record, 2017 - 2018

Math 142A, 142B (Introduction to Analysis I, II)

Math 18 (Linear Algebra)

Math 20B (Calculus for Science and Engineering II)

University of California, Los Angeles, Los Angeles, California, USA

Teaching Assistant, 2013 - 2015

PIC 10A (Introduction to Programming) - Fall 2015
Math 170A (Probability Theory) - Summer 2015
Math 131A (Real Analysis) - Spring 2014
Math 115A (Linear Algebra) - Winter 2014
PIC 10B (Intermediate Programming) - Winter 2014
Math 32A (Calculus of Several Variables) - Fall 2013
Math 3A (Calculus for Life Sciences Students) - Fall 2013

University of Waterloo, Waterloo, Ontario, Canada

University Marker, 2008, 2011

Math 147 (Advanced Calculus 1) - Fall 2008
Math 247 (Advanced Calculus 3) - Winter 2011

Undergraduate Mathematics Society, 2011

Linear Algebra Enrichment Lectures - Winter 2011

Service

Organization of meetings, conferences, and seminars

Connes Embedding/MIP* = RE Reading Group at the University of California, Berkeley and Simons Institute, Winter 2020.

Joint Mathematics Meetings 2020 AMS Special Session on Advances in Operator Algebras. Co-organized with Brent Nelson, Sarah Reznikoff, and Lauren Ruth.

Joint Mathematics Meetings 2018 AMS Special Session: Advances in Operator Algebras. Co-organized with Marcel Bischoff, Brent Nelson, and Sarah Reznikoff.

Trimester Junior Seminar during the 2016 von Neumann Algebras Trimester of the Hausdorff Research Institute for Mathematics, Universität Bonn.

Refereeing

Journal of Functional Analysis
Journal of Operator Theory
Proceedings of the American Mathematical Society
Random Matrices: Theory and Applications