

Ferenc Balogh

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Research Interests

Random matrices, orthogonal polynomials, Riemann–Hilbert problems
Equilibrium measures, quadrature domains, conformal mappings
Integrable hierarchies, τ -functions, symmetric functions

Current position

Teacher of Mathematics John Abbott College, Ste-Anne-de-Bellevue	Aug. 2015 - present
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Past employment

Research assistant professor Concordia University, Montréal	Jan. 2015 - Aug. 2015
Postdoctoral research assistant Mathematics Area, SISSA, Trieste	Sept. 2012 - Dec. 2014
Research assistant professor Concordia University, Montréal	Sept. 2011 - June 2012 Jan. 2011 - May 2011
Postdoctoral researcher Centre des recherches mathématiques (CRM), Montréal	Jan. 2011 - July 2012

Visiting positions

Invited participant Thematic semester on Random Matrices and Scaling Limits Mittag-Leffler Institute, Stockholm, Sweden	Dec. 2024
Summer research internship Centre for Nonlinear Studies, Los Alamos National Laboratory	May - July 2008

Consulting activities

External consultant <i>Development of a standard food authenticity testing workflow for honey using non-targeted LC/MC analysis</i> , NSERC Alliance program grant Principal investigator: Prof. Stéphane Bayen Department of Food Science and Agricultural Chemistry, McGill University	June 2022 - June 2024
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Professional affiliations

Affiliate Assistant Professor Department of Mathematics and Statistics Concordia University, Montréal	June 2016 - June 2019
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Education

Ph.D in Mathematics Concordia University, Montréal (Supervisor: Prof. John Harnad)	2010
M.Sc in Mathematics with distinction University of Szeged, Hungary (Supervisor: Prof. László Kérchy)	2004

Grants

FRQNT research grant Programme de recherche pour les chercheurs et les chercheuses de collège <i>Asymptotics of eigenvalue statistics in planar random matrix models</i> 2019-CO-261822	2018 - 2021
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Honors and awards

The 2011 Distinguished Doctoral Dissertation Prize in Engineering and Natural Sciences Concordia University	2011
Mathematics and Statistics Graduate Scholarship Department of Mathematics and Statistics, Concordia University	2009
Campaign for Concordia – Graduate Award Concordia University	2008
Campaign for a new Millennium – Student Contribution Graduate Scholarship Concordia University	2008
Best Student Award Mathematical Physics Laboratory, Centre de Recherches Mathématiques	2008
Campaign for a new Millennium – Graduate Scholarship School of Graduate Studies, Concordia University	2006
ISM Scholarship for Graduate Studies Institut des Sciences Mathématiques, Montréal	2006 2005
Excellent Student of the Faculty of Science Faculty of Science, University of Szeged	2004

Academic service

Department co-chair Mathematics Department, John Abbott College	Sept. 2020 - June 2023
Seminar co-organizer Séminaire Physique Mathématique, CRM	Sept. 2020 - Dec. 2021
Conference organizer ASIDE 2016, CRM, Montréal	Sept. 2015 - Dec. 2015
Seminar organizer Integrable systems and Mathematical Physics Seminar, SISSA	Sept. 2013 - Aug. 2014
Journal referee Nonlinearity, Stud. Appl. Math., Math. Rev.	2010 - present
Webmaster Homepage of the Mathematical Physics Laboratory, CRM	Jan. 2011 - June 2012

Published research articles

- [1] S. Chahal, L. Tian, S. Bilamjian, F. Balogh, L. De Leoz, T. Anumol, D. Cuthbertson, S. Bayen. Rapid Convolutional Algorithm for the Discovery of Blueberry Honey Authenticity Markers via Nontargeted LC-MS Analysis, *Anal. Chem.* 96, 45 (2024) 17922–17930
doi:10.1021/acs.analchem.4c01778
- [2] F. Balogh. On longest increasing subsequences in words in which all multiplicities are equal, *J. Integer Seq.* 26 (2023) Article 23.7.3
Preprint: arxiv:1505.01389
- [3] F. Balogh, J. Harnad, J. Hurtubise. Isotropic Grassmannians, Plücker and Cartan maps. *J. Math. Phys.* 62 (2): 021701 (2021)
doi:10.1063/5.0021269, Preprint: arxiv:2007.03586
- [4] F. Balogh, D. Yang. Geometric interpretation of Zhou’s explicit formula for the Witten-Kontsevich tau function, *Lett.Math.Phys.* 107 (2017) 10, 1837-1857
doi:10.1007/s11005-017-0965-8, Preprint: arxiv:1412.4419
- [5] F. Balogh, T. Grava, D. Merzi. Orthogonal polynomials for a class of measures with discrete rotational symmetries in the complex plane. *Constr. Approx.* 46, 109-169 (2017)
doi:10.1007/s00365-016-9356-0, Preprint: arxiv:1509.05331
- [6] F. Balogh, M. Bertola, T. Bothner. Hankel Determinant Approach to Generalized Vorob’ev-Yablonski Polynomials and Their Roots, *Constr. Approx.* 44, 417-453 (2016)
doi:10.1007/s00365-016-9328-4, Preprint: arxiv:1504.00440
- [7] S.T. Ali, F. Balogh and N. M. Shah. On Some Families of Complex Hermite Polynomials and their Applications to Physics. *Operator Algebras and Mathematical Physics, Series: Operator Theory: Adv. and Appl.*, 157-171 (2015)
doi:10.1007/978-3-319-18182-0, Preprint: arxiv:1309.4163
- [8] F. Balogh. Discrete matrix models for partial sums of conformal blocks associated to Painlevé transcendents. *Nonlinearity*, **28** (1):43-55 (2015)
doi:10.1088/0951-7715/28/1/43, Preprint: arxiv:1405.1871
- [9] F. Balogh, T. Fonseca, and J. Harnad. Finite dimensional KP tau-functions. I. Finite Grassmannians. *J. Math. Phys.*, **55**:083517 (2014)
doi:10.1063/1.4890818, Preprint: arxiv:1403.5835
- [10] F. Balogh and É. Krauczi. Weighted quantile correlation test for the logistic family. *Acta Sci. Math. (Szeged)*, **80**:307-326 (2014)
doi:10.14232/actasm-013-809-8, Preprint: arxiv:1402.0369
- [11] F. Balogh and D. Merzi. Equilibrium measures for a class of potentials with discrete rotational symmetries. *Constr. Approx.* **42** (3), 399-424 (2015)
doi:10.1007/s00365-015-9283-5, Preprint: arxiv:1312.1483
- [12] T. Fonseca and F. Balogh. The higher spin generalization of the 6-vertex model with domain wall boundary conditions and Macdonald polynomials. *J. Algebraic Combin.* **41** (3): 843-866 (2015)
doi:10.1007/s1080-014-0555-0, Preprint: arxiv:1210.4527
- [13] F. Balogh, M. Bertola, S. Y. Lee, and K. D. T.-R. McLaughlin. Strong asymptotics of the orthogonal polynomials with respect to a measure supported on the plane. *Comm. Pure Appl. Math.*, **68**: 112-172 (2015)
doi:10.1002/cpa.21541, Preprint: arxiv:1209.6366

- [14] F. Balogh and J. Harnad. Superharmonic perturbations of a Gaussian measure, equilibrium measures and orthogonal polynomials. *Complex Anal. Oper. Theory*, **3** (2): 333-360 (2009)
doi:10.1007/s11785-008-0101-y, Preprint: arxiv:0808.1770
- [15] F. Balogh and M. Bertola. Regularity of a vector potential problem and its spectral curve. *J. Approx. Theory*, **161** (1): 353-370 (2009)
doi:10.1016/j.jat.2008.10.010, Preprint: arxiv:0804.4700

Books

- [16] J. Harnad and F. Balogh. *Tau Functions and Their Applications*. Cambridge University Press (2021)

Conference and seminar talks, poster presentations

- [1] *From Ptolemy to Plücker, Grassmann, Schur, and beyond*, $(MD)^2$, August 18, 2023, John Abbott College
- [2] *Where do the rational solutions of the Painlevé II hierarchy come from?*, Painlevé Equations in the Midwest, August 24, 2019, U. of Michigan - Ann Arbor, MI
- [3] *On the distribution of poles of rational solutions to the Painlevé II hierarchy*, Séminaire Physique Mathématique, March 6, 2018, CRM
- [4] *Asymptotics of Painlevé tau functions and a discrete matrix model*, Séminaire Structures Algébriques et Géométriques, Jan. 28, 2016, Université de Sherbrooke
- [5] *Orthogonal Polynomials for a Class of Measures with Discrete Rotational Symmetries in the Complex Plane*, SIAM Conference on Orthogonal Polynomials, Special Functions and Applications 2015, June 3, 2015, NIST, Gaithersburg, MD
- [6] *Finite dimensional tau-functions*, Séminaire Physique Mathématique, April 14, 2015, CRM
- [7] *Conjectured asymptotic expansions for Painlevé tau functions and a discrete matrix model I-II*, Working Seminar on Integrable Systems, March 10 and 17, 2015, Concordia University
- [8] *Orthogonal polynomials for normal matrix models with discrete rotational symmetries*, USF Math Colloquium, Febr. 27, 2015, University of South Florida, Tampa, FL
- [9] *Finite dimensional tau-functions*, Working Seminar on Integrable Systems, Oct. 24, 2014, Concordia University
- [10] *Discrete matrix models for partial sums of conformal blocks associated to Painlevé transcendents*, Séminaire Physique Mathématique Sept. 9, 2014, CRM
- [11] *A discrete matrix model for the conformal blocks associated with the Painlevé transcendents*, Integrable Systems and Mathematical Physics Seminar, March 12, 2014, SISSA
- [12] *Equilibrium measures for a class of potentials with discrete rotational symmetries* (poster presentation with co-author D. Merzi), Advanced School and Workshop on Random Matrices and Growth Models, Sept. 10, 2013, ICTP Trieste
- [13] *Asymptotics of orthogonal polynomials associated to a random normal matrix model I-IV*, Integrable Systems Seminar, Jan.-Febr. 2013, SISSA
- [14] *The six-vertex model partition function from a Grassmannian point of view*, Working Seminar on Integrable Systems, Nov. 8, 2012, Concordia University

- [15] *Reduction of planar orthogonality to non-hermitian orthogonality on contours*, Canadian Mathematical Society - Summer Meeting 2012, June 3, 2012, Regina, SK
- [16] *Wronskians of Hermite polynomials*, Working Seminar on Integrable Systems, March 29, 2012, Concordia University
- [17] *Plancherel process on partitions I-II*, Working Seminar on Integrable Systems, Oct. 13 and 21, 2010, Concordia University
- [18] *Reduction of planar orthogonality to non-hermitian orthogonality on contours*, 13th International Conference on Approximation Theory, March 7-10, 2010, San Antonio, TX
- [19] *Asymptotics of Bargmann–Fock-type orthogonal polynomials*, Université Laval Mathematical Analysis Seminar, Febr. 27, 2009, Université Laval
- [20] *Random Matrices, Laplacian Growth and Localization for Planar Orthogonal Polynomials*, Center for Nonlinear Studies Seminar, July 10, 2008, CNLS, Los Alamos National Laboratory
- [21] *On the asymptotic zero distribution of some planar orthogonal polynomials*, Conference on Hilbert Spaces of Analytic Functions Dec. 12, 2008, CRM
- [22] *On the asymptotics of some planar orthogonal polynomials*, BIRS Workshop on Random Matrices, Inverse Spectral Methods and Asymptotics, Oct. 5, 2008, Banff International Research Station
- [23] *Localization phenomena for orthogonal polynomials in the plane*, CRM International Workshop on Laplacian Growth and Related Topics, (Thematic Year on Probabilistic Methods in Math. Phys.), Aug. 22, 2008, CRM
- [24] *Equilibrium Measures, Schwarz Functions and Asymptotics of Orthogonal Polynomials* Séminaire Physique Mathématique, Dec. 11, 2007, CRM
- [25] *Véletlen mátrixok, elektrosztatika és ortogonális polinomok (Random Matrices, Electrostatics and Orthogonal Polynomials)*, Stochastics Seminar of the Bolyai Institute (in Hungarian), Aug. 29, 2007, University of Szeged, Hungary
- [26] *Orthogonal Polynomials for Exponential Type Weights on the Complex Plane and Generalized Quadrature Domains*, BIRS Workshop on Quadrature Domains and Laplacian Growth in Modern Physics, June 15-20, 2007, Banff International Research Station

Teaching experience

John Abbott College, Ste-Anne-de-Bellevue

- ▲ *Calculus I,II*
- ▲ *Algebra and Functions, Algebra and Trigonometry*
- ▲ *Statistics*
- ▲ *Statistical Methods* (science option course)
- ▲ *Independent Research Project in Science*

Concordia University, Montréal

- ▲ *Fundamental Mathematics II*, Winter 2015, Winter 2011, Winter 2009, Fall 2008
- ▲ *Linear Algebra*, Summer 2012
- ▲ *Differential and Integral Calculus II*, Winter 2012, Fall 2011, Winter 2011
- ▲ *Elementary Functions*, Winter 2008
- ▲ *Discrete Mathematics* (practice sessions), Fall 2010
- ▲ *Elementary Numerical Methods* (practice sessions), Winter 2010

Scuola Internazionale Superiore di Studi Avanzati (SISSA), Trieste, Italy

- ▲ *KP τ -functions and their applications* (graduate course), Spring 2014

University of Szeged, Hungary

- ▲ *Time Series Analysis*, Spring 2005
- ▲ *Algebra and Geometry I*, Fall 2003, Fall 2004
- ▲ *Algebra and Geometry II*, Spring 2004, Spring 2005
- ▲ *Calculus II*, Spring 2003
- ▲ *Calculus I for Physicists*, Fall 2001, Fall 2002
- ▲ *Calculus II for Physicists*, Spring 2002

Teaching-related activities

Math contest organizer Mathematics Department, John Abbott College	Fall 2022 - present
Math Explorations Club co-organizer Mathematics Department, John Abbott College	Fall 2021 - present
Exam invigilator Canadian Kangaroo Mathematics Contest, Montréal	March 2015
Science fair judge The Study, Montréal	Feb. 2015
Science fair judge Hydro-Québec Montréal Regional Science & Technology Fair	March 2011
Putnam math contest coach Concordia University	2009–2010
Open House representative Department of Mathematics and Statistics, Concordia University	Jan. 2009
Exhibition demonstrator Concordia Expo-Science, Pointe-Claire, mathematics section	Nov. 2007