Ferenc Balogh

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https://ferenc-balogh-math.github.io

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 — **Aug. 2015 - present**
John Abbott College, Ste-Anne-de-Bellevue

Past employment

Research assistant professor — **Jan. 2015 - Aug. 2015**
Concordia University, Montréal

Postdoctoral research assistant — **Sept. 2012 - Dec. 2014**
Mathematics Area, SISSA, Trieste

Research assistant professor — **Sept. 2011 - June 2012**, **Jan. 2011 - May 2011**
Concordia University, Montréal

Postdoctoral researcher — **Jan. 2011 - July 2012**
Centre des recherches mathématiques (CRM), Montréal

Visiting positions

Invited participant — **Dec. 2024**
Thematic semester on Random Matrices and Scaling Limits
Mittag-Leffler Institute, Stockholm, Sweden

Summer research internship — **May - July 2008**
Centre for Nonlinear Studies, Los Alamos National Laboratory

Consulting activities

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

Professional affiliations

Affiliate Assistant Professor — **June 2025 - present**, **June 2016 - June 2019**
Department of Mathematics and Statistics
Concordia University, Montréal

Education

Ph.D in Mathematics **2010**
Concordia University, Montréal (Supervisor: Prof. John Harnad)

M.Sc in Mathematics **2004**
with distinction
University of Szeged, Hungary (Supervisor: Prof. László Kérchy)

Grants

FRQNT research grant **2018 - 2021**
Programme de recherche pour les chercheurs et les chercheuses de collège
Asymptotics of eigenvalue statistics in planar random matrix models
2019-CO-261822

Honors and awards

The 2011 Distinguished Doctoral Dissertation Prize in Engineering and Natural Sciences **2011**
Concordia University

Mathematics and Statistics Graduate Scholarship **2009**
Department of Mathematics and Statistics, Concordia University

Campaign for Concordia – Graduate Award **2008**
Concordia University

Campaign for a new Millennium – Student Contribution Graduate Scholarship **2008**
Concordia University

Best Student Award **2008**
Mathematical Physics Laboratory, Centre de Recherches Mathématiques

Campaign for a new Millennium – Graduate Scholarship **2006**
School of Graduate Studies, Concordia University

ISM Scholarship for Graduate Studies **2006**
Institut des Sciences Mathématiques, Montréal **2005**

Excellent Student of the Faculty of Science **2004**
Faculty of Science, University of Szeged

Academic service

Department co-chair **Sept. 2020 - June 2023**
Mathematics Department, John Abbott College

Seminar co-organizer **Sept. 2020 - Dec. 2021**
Séminaire Physique Mathématique, CRM

Conference organizer **Sept. 2015 - Dec. 2015**
ASIDE 2016, CRM, Montréal

Seminar organizer **Sept. 2013 - Aug. 2014**
Integrable systems and Mathematical Physics Seminar, SISSA

Journal referee **2010 - present**
Nonlinearity, Stud. Appl. Math., Math. Rev.

Webmaster **Jan. 2011 - June 2012**
Homepage of the Mathematical Physics Laboratory, CRM

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 Plcker, 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 Géometriques, 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 **Fall 2022 - present**
Mathematics Department, John Abbott College

Math Explorations Club co-organizer **Fall 2021 - present**
Mathematics Department, John Abbott College

Exam invigilator **March 2015**
Canadian Kangaroo Mathematics Contest, Montréal

Science fair judge **Feb. 2015**
The Study, Montréal

Science fair judge **March 2011**
Hydro-Québec Montréal Regional Science & Technology Fair

Putnam math contest coach **2009–2010**
Concordia University

Open House representative **Jan. 2009**
Department of Mathematics and Statistics, Concordia University

Exhibition demonstrator **Nov. 2007**
Concordia Expo-Science, Pointe-Claire, mathematics section