Anna Maltsev

CONTACT INFORMATION

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PERSONAL

Born *October 1983*. American citizen.

EMPLOYMENT

◇ **Queen Mary University of London**
Royal Society University Research Fellow and Proleptic Senior Lecturer in Applied Probability, *September 2019 - present.*
Maternity leave, May 2020 – September 2020.
Royal Society University Research Fellow and Proleptic Lecturer in Applied Probability, *September 2017 - September 2019.*

◇ **University of Bath**
Teaching Fellow, *February 2017 – July 2017.*

◇ **University of Bristol**
Leverhulme Early Career Fellow, *September 2013 – January 2017.*
Maternity leave, October 2015 – February 2016.
Temporary Lecturer, *September 2012 – October 2013.*

◇ **University of Bonn**
Postdoc at Hausdorff Center for Mathematics, *September 2010 – September 2012.*

◇ **National Institutes of Health (NIH), National Institute on Aging (NIA)**
Summer student with Intramural Research Training Award in Summers 2005, 2006 & 2009. Supervisors: Profs. Stern, Lakatta, and Soldatov.

EDUCATION

◇ **California Institute of Technology**
Ph.D. in Mathematics, *June 2010.*
Thesis advisor: *Barry Simon.*

◇ **University of Michigan**
B. S. Economics and Mathematics (Hons.), *June 2005.*

RESEARCH INTERESTS

◇ Mathematical physics and probability: random matrix theory, random fermionic systems, spectral theory, quantum graphs.

◇ Mathematical biology and biophysics: applications of the Ising model and random matrix theory to quantitative biology, intracellular calcium signaling and clocking mechanisms, cell-to-cell interactions, wavelet analysis.

GRANTS

◇ **Royal Society Enhanced Research Expenses for Research Fellow Renewals**. Funding for a postdoctoral research assistant *April 2023 - March 2026.* Value of award: £240,000

◇ **Royal Society University Research Fellowship Renewal**, *February 2023 – February 2026.* "Random Geometric Graphs and Related Problems: Theory and Applications". Value of award: £364,397

◇ **Royal Society Additional Research Expenses**. Funding for Undergraduate internship *May 2023 - October 2023.* Value of award: £6000

◇ **Royal Society Additional Research Expenses**. Funding for Undergraduate internship *May 2022 - October 2022.* Value of award: £5000

◇ **Royal Society Research Fellow Enhanced Research Expenses**. Funding for a postdoctoral research assistant *April 2022 - March 2023.* Value of award: £85,000

⋄ **Royal Society Research Grants for Research Fellows** for a project entitled "Wigner matrices with few moments and fractional Brownian motions." Funding for a Ph.D. studentship *April 2019*. Value of award: £101,344

⋄ **London Mathematical Society 'Celebrating New Appointments' Scheme 9 Grant**. Funding to organize a conference "Gaussian fields: geometry and applications." *June 2019*. Value of award: £600

⋄ **Royal Society University Research Fellowship**, *October 2017 – February 2023*. "Spectral Universality for Random Matrices". Value of award: £459,942

⋄ **Leverhulme Early Career Fellowship**, *September 2013 - Jan 2017*. "Local Eigenvalue Statistics and Universality for Random Non-Hermitian Matrices". Value of award: 50% of salary for 3 years, plus £18,000 in research expenses

⋄ **EPSRC Standard Grant** (co-I), *August 2014 - July 2017*. "Wegner estimates and universality for non-Hermitian matrices". Value of award: £272,934

PUBLICATIONS   Notes:

A) Papers denoted below by (M) follow the conventions of mathematics, with all the authors having contributed equally and listed strictly in alphabetical order.

B) Papers denoted below by (B) follow the conventions of biophysical and biomedical journals, with the lead author listed first, the senior author listed last, and corresponding author denoted with *.

⋄ (M) **Local Marchenko-Pastur law at the hard edge of the Sample Covariance ensemble,** (with A. Kafetzopoulos), preprint arXiv:2206.01971, in revision in *Journal of Mathematical Physics.*

⋄ (B) **Elementary Intracellular Ca Signals are Initiated by a Transition of Release Channel System from a Metastable State,** (G. Veron, V. Maltsev, M. Stern, and A.Maltsev*) Preprint. arXiv:2105.01340, in revision in *Journal of Applied Physics*

⋄ (B) **Meaningful Local Signalling in the Sinoatrial Node Center Identified by Random Matrix Theory and PCA,** (C. Norris and A. Maltsev*) Journal of Physics: Complexity. 2022 Dec 21.

⋄ (B) **Disorder in Ca2+ Release Unit Locations Confers Robustness but Cuts Flexibility of Heart Pacemaking,** (A. Maltsev*, M. Stern, and V. Maltsev) Journal of General Physiology 154.9 (2022): e202113061.

⋄ (B) **Universal inverse square relationship between heart rate variability and heart rate,** (A. Maltsev*, O. Monfredi, and V. Maltsev) Clinical Electrophysiology 8.8 (2022): 1042-1044.

⋄ (M) **Covariance Kernel of Half-heavy Tailed Random Matrix Eigenvalues,** (with A. Lodhia) *Random Matrices: Theory and Applications* (2022): 2250054.

⋄ (B) **Mechanisms of Calcium Leak from Cardiac Sarcoplasmic Reticulum Revealed by Statistical Mechanics** (A. Maltsev, M. Stern, and V. Maltsev*) *Biophysical Journal*, Volume 116, Issue 11, 4 June 2019, Pages 2212-2223.

⋄ (M) **Localization and landscape functions on quantum graphs.** (with E. Harrell), Trans. AMS (2020), 373: 1701-1729.

⋄ (M) **On Agmon metrics and exponential localization for quantum graphs.** (with E. Harrell), *Comm. Math. Phys.*, (2018) 359(2): 429 - 448.

⋄ (M) **Clusters of calcium release channels harness the Ising phase transition to confine their elementary intracellular signals.** (with V. Maltsev and M. Stern,) *Proc. Natl. Acad. Sci. USA*, (2017), 114(29): 7525–7530.

⋄ (M) **Density and spacings for the energy levels of Quadratic Fermi operators.** (with

Fabio Deelan Cunden and Francesco Mezzadri) *J. Math. Phys.* (2017), 58, 061902.

⋄ (M)**Fluctuations of linear statistics of half-heavy-tailed random matrices.** (with F. Benaych-Georges), *Stoch. Proc. Appl.*, (2016), 126(11): 3331–3352.

⋄ (M)**Fluctuations in the two-dimensional one-component plasma and associated fourth-order phase transition.** (with Fabio Deelan Cunden and Francesco Mezzadri) *Phys. Rev. E*, (2015), 91, 060105(R).

⋄ (M)**Bounds for the Stieltjes Transform and the Density of States for Wigner Matrices.** (with C. Cacciapuoti and B. Schlein) *Probab. Theory Related Fields*, (2015), 163(1-2): 1-59.

⋄ (B)**Modern perspectives on numerical modeling of cardiac pacemaker cell** (V. Maltsev, Y. Yaniv, A. Maltsev, M. Stern, E. Lakatta) *J Pharmacol Sci.* (2014), 125(1):6-38.

⋄ (B)**RyR-NCX-SERCA local cross-talk ensures pacemaker cell function at rest and during the fight-or-flight reflex** (A.Maltsev, Y. Yaniv, M. Stern, E. Lakatta, and V. Maltsev*) *Circ. Res.* (2013), first author paper.

⋄ (M)**Local Marchenko-Pastur Law at the Hard Edge of Sample Covariance Matrices** (with C. Cacciapuoti and B. Schlein), *J. Math. Phys.* (2013) 54(4), 043302

⋄ (M)**Average Density of States for Hermitian Wigner Matrices** (with B. Schlein), *Adv. Math.* (2011), 228(5):2797–2836.

⋄ (B)**Synchoronization of stochastic Ca^{2+} release units creates a rhythmic Ca^{2+} clock in cardiac pacemaker cells** (A. Maltsev, V.Maltsev, M. Mikheev, L. Maltseva, S.Sirenko, E.Lakatta, M.Stern*), *Biophys. J.* (2011), 100(2):271-283.

⋄ (M)**A Wegner estimate for Wigner matrices** (with B. Schlein), *Entropy and the Quantum II*, pages 145-160, Arizona School of Analysis with Applications, Amer. Math. Soc., 2011.

⋄ (M)**Universality Limits of a Reproducing Kernel for a Half-Line Schrodinger Operator and Clock Behavior of Eigenvalues**, *Comm. Math. Phys.* (2010), 298(2):461-484.

⋄ (B)**A parallel implementation of an agent-based modeling platform with application in modeling calcium releases in cardiomyocytes** (M. Mikheev, A. Solovyev, A. Maltsev, J. Bartels, S. Chang, Q. Mi, Y. Vodovotz), *J. Critical Care* (2009), 24(3): e21.

⋄ (B)**Analysis of functional signaling domains from fluorescence imaging and the two-dimensional continuous wavelet transform** (D. Mager, E. Kobrinsky, A. Masoudieh, A. Maltsev, D. Abernethy, and N. Soldatov.), *Biophys. J.* (2007), 93:2900-2910.

⋄ (B)**Wavelet-based analysis of FRET microscopy** (E. Kobrinsky, A. Maltsev, N. Soldatov, D. Abernethy, D. Mager), *Biophotonics International* (2005), 12:49-50.

PRESENTATIONS   ⋄ **Invited Conference and Workshop Talks**

Applications of Random Matrices in Economics and Statistics, Oxford, May 2023.

Brunel-Bielefeld Workshop on Random Matrix Theory, ZiF Bielefeld, December 2021.

Equadiff 2019, "Spectral theory and PDEs on metric graphs" minisymposium, Leiden, July 2019.

Dynamics Minisymposium, Loughborough University, September 2018.

Workshop on Network dynamics, University of Exeter, April 2018.

Special section on Recent Advances in Approximation Theory and Operator Theory, AMS sectional meeting at Ohio, March 2018.

Western States Mathematical Physics Meeting, University of California at Irvine, February 2018.

Park City Mathematics Institute 2017 Graduate Summer School and Research Program. July 2017.

Brunel-Bielefeld Workshop on Random Matrix Theory, Brunel University, December 2016.

Extrema of Logarithmically Correlated Processes, Characteristic Polymials, and the Riemann Zeta Function, Heilbronn Institute for Mathematical Research, University of Bristol, May 2016.

New Mathematical Methods for Open Quantum Systems, University of Bristol, May 2016.

Random Matrix Theory and Strongly Correlated Systems Workshop, University of Warwick, March 2016.

Pre-workshop Programme, University of Warwick, March 2016, review lecture.

Workshop on Laplacians and Heat Kernels, BIRS, Banff, Canada, March 2015

Warsaw Summer School in Probability, University of Warsaw, June 2015, educational lecture.

32nd Annual Western States Mathematical Physics Meeting. Caltech, Pasadena, USA, February 2014.

28th Annual Western States Mathematical Physics Meeting, Caltech, Pasadena, USA, February, 2010.

◇ **Poster Presentations (biophysics)**
Spatial Imperfection Encodes Functional Perfection: Success and Failure of Calcium Release to Propagate Regulate Pacemaker Cell Function (with V. Maltsev, M. Stern, E. Lakatta) *Biophysical Journal, Vol. 106, Issue 2, p319a. Published in issue: January 28, 2014.*

A New Simplified 3D Model of Cardiac Pacemaker Cell Based on Superresolution Structured Illumination Microscopy (SIM) (with V. Maltsev, O. Monfredi, H. Shroff, A. G. York, E. Lakatta, M. Stern) *Biophysical Journal, Vol. 108, Issue 2, p569a. Published in issue: January 27, 2015.*

◇ **Seminar Talks: a selection**
UCL Colloquium. November 2022.

Random Matrices Seminar, Oxford University. April 2022.

Bielefeld Melbourne Random Matrices Seminar. October 2021.

Orthogonal Polynomials, Special Functions, Operator Theory and Applications. March 2021.

KUL–UCL classical analysis and integrable systems seminar. December 2020.

University of Cambridge. April 2019.

University of Bristol, Mathematical Physics Seminar. Dec 2018.

University of Manchester, Cardiovascular Seminar Series. Nov 2018.

University of Nottingham, Centre for Mathematical Medicine and Biology Seminar Series. Oct 2018.

University of Warwick, Probability Seminar. June 2016.

University of Copenhagen, Mathematical physics seminar. June 2015

University of Warwick, Statistical Mechanics Seminar. October 2012, January 2014, November 2017.

University of Illinois at Urbana-Champaign, Seminar. October 2013.

University of Bristol, Mathematical Physics Seminar. October 2012, March 2014.

Hausdorff Institute for Mathematics. June 2012.

Georgia Tech University. July 2011, March 2012, November 2013.

University of Bonn. Stochastics Seminar. October 2011, February 2011.

Mount Sinai Medical School. New York, NY. Biophysics Seminar. April 2010.

University of Southern California Dynamical Systems Seminar. February 2010.

University of California, Los Angeles. Biophysics Seminar. January 2010.

University of California, Irvine. Math-Physics seminar. December 2009.

Caltech Mathematical Physics seminar. October 2009.

◇ **Contributed Talks**

Biophysical Meeting 2020. San Diego, February 2021.

Brunel-Bielefeld Random Matrix Theory Workshop. Brunel University, UK, December 2018.

International Congress on Mathematical Physics, Montreal, Candada, July 2018.

62nd Annual Biophysical Society Meeting, San Francisco, USA, February 2018.

International Congress on Mathematical Physics, Santiago, Chile, July 2015.

58th Annual Biophysical Society Meeting, San Francisco, USA, February 2014.

Brunel-Bielefeld Random Matrix Theory Workshop. University of Bielefeld, Germany, December 2014.

Brunel-Bielefeld Random Matrix Theory Workshop. University of Brunel, UK, December 2013.

54th Annual Biophysical Society Meeting , San Francisco USA, February 2010.

Meeting of Orthogonal Polynomials, Special Functions, and Applications, Leuven, Belgium, July 2009.

51st Annual Biophysical Society Meeting, Baltimore USA, February 2007.

Joint Meetings of the Mathematical Association of America and American Mathematical Society, 2004.

RESEARCH SUPERVISION

◇ **PDRA mentoring**
Mohammed Osman, *April 2022 –*

◇ **Ph.D. supervision**
Anastasis Kafetzopoulos *April 2019 –*

Svetlana Malysheva *October 2019 –*

◇ **Postbac Intramural Research Training Award, National Institutes of Health US**
Guillermo Veron *Summer 2019*

◇ **Research Student Intern**
Chloe Norris *Fall 2021*

TEACHING EXPERIENCE

◇ **Queen Mary University of London**

Lecturer
Topics in probability and Stochastic processes, Autumn 2023.

MSc Supervisor for Financial Mathematics. Project on heavy tailed distributions in finance.

Students: Supajarus Luppayanukul (Spring-Summer 2018) and Katrin Kofoed (Spring-Summer 2019)

◇ **University of Bath**

Lecturer
Analysis 2B: Multivariable and Complex Analysis, Spring 2018.

Graphs and Networks, Spring 2018.

Tutor and Teaching Assistant
Mathematics Drop-in Centre (math tutoring), Spring 2018.

Communicating Mathematics, Spring 2018.

◇ **University of Bristol**

Lecturer
Mathematical Methods, Spring 2014, 2015, 2016.

Quantum Mechanics, Spring 2013.

Random Matrix Theory, Spring 2013.

Tutor
    Calculus, Fall - Spring 2012-13.

    Computational maths, Fall 2012.

    Mechanics, Fall 2013.

⋄ **University of Bonn**

Lecturer
    Topics Course on Reproducing Kernels and Applications, Fall 2011.

⋄ **California Institute of Technology**

Teaching Assistant (recitation sessions and grading)
    Linear Algebra 1 (Winter 2010)

    Calculus 1 (Fall 2006, Fall 2009)

    Differential Equations (Fall 2008, Fall 2007)

    Probability and Statistics (Winter 2008-09, Winter 2007-08)

    Multivariable calculus (Spring 2008)

Teaching Assistant (grading and office hours)
    Real analysis

    Complex Analysis

    Differential topology

    Chaos theory and dynamical systems

⋄ **University of Michigan**

Teaching Assistant (grading)
    Honors Introduction to Analysis I (Fall 2002)

SERVICE

⋄ Organizer of *Royal Statistical Society Applied Probability Section Meeting* conference held virtually in April 2021.

⋄ Founder and organizer of the *Random Matrix Theory Reading Group* 2018-2020 at Queen Mary University of London

⋄ Organizer of *Gaussian Fields: Geometry and Applications in Random Matrix Theory* conference held at Queen Mary University of London in June 2019.

⋄ Member of the *Applied Probability Committee* of the Royal Statistical Society 2018-current.

⋄ Staff representative on the *Health and Safety Committee*, Queen Mary University London 2018-2019.

⋄ Organizer of the *Mathematical Physics Seminar* at the University of Bristol, 2013-2015.

⋄ Organizer of the *Mathematical Physics Student Talks Day* at the University of Bristol, May 2013, 2014.

⋄ Have refereed for various journals including *Probability Theory and Related Fields* , *Advances in Mathematics*, and *Physical Review Letters*.

REFERENCES

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