Dr Jonathan Ben-Artzi

Research Areas Analysis of Nonlinear PDEs; Kinetic Theory; Spectral Approximation & Computation; Smooth Ergodic Theory & Continuous-Time Dynamical Systems; Functional inequalities

Employment

Cardiff University, Cardiff, UK — Since September 2016

School of Mathematics
Reader (Associate Professor), since 2019
Senior Lecturer, 2016-2019

EPSRC Early Career Fellow, 2016-2022

Imperial College London, London, UK — 2014-2017

Junior Research Fellow, *Department of Mathematics*

University of Cambridge, Cambridge, UK — 2011-2014

Research Associate jointly at:
Cambridge Centre for Analysis
Department of Applied Mathematics and Theoretical Physics

Supernumerary Fellow, *Pembroke College*

Education

Brown University, Providence, Rhode Island, USA

Ph.D., Mathematics — May 2011
Advisor: Walter A. Strauss

M.Sc., Applied Mathematics — May 2009

M.Sc., Mathematics — May 2008

Teaching Certificate — May 2008

Hebrew University of Jerusalem, Jerusalem, Israel

B.Sc., Mathematics-Physics (dual degree) — June 2006

Fellowships, Grants & Awards

Marie Skłodowska-Curie Fellowship: €212,934 (ref. 885904, score: 93.2%) — 2020-2022
European Commission (role: supervisor of Dr Frank Rösler)

Marie Skłodowska-Curie Fellowship: €195,455 (ref. 790623, score: 100%) — 2018-2020
European Commission (role: supervisor of Dr Junyong Zhang)

LMS Research in Pairs (Scheme 4): £1200 (ref. 41817) — November 2018
London Mathematical Society (for visit of Prof. Stephen Pankavich)

Outstanding Contribution Award — October 2018
Cardiff University

SCoRE Cymru: £600 for visit of Dr Junyong Zhang (ref. SC17003) — April 2017
Welsh European Funding Office

EPSRC Early Career Fellowship: £977,978 (ref. EP/N020154/1) — 2016-2022
UK Engineering and Physical Sciences Research Council

Conference funding for the conference *"The Cauchy Problem in Kinetic Theory: Recent Progress in Collisionless Models"*, Imperial College London, September 2015:

❑ **LMS Conference Grant (Scheme 1): £7,000** (ref. 11443) March 2015
London Mathematical Society

❑ **EPSRC Platform Grant: £10,000** (ref. W031JB) February 2015
Department of Mathematics, Imperial College London

Junior Research Fellowship: £175,000 2014-2017
Imperial College London

Supernumerary Fellowship 2011-2013
Pembroke College, Cambridge

Outstanding Teaching Award May 2011
Department of Mathematics, Brown University

Young Researcher Travel Award April 2011
The Seventh IMACS Conference

Coline M. Makepeace Fellowship 2006-2007
Graduate School, Brown University

Preprints

24. Modified scattering of solutions to the relativistic Vlasov-Maxwell system inside the light cone
(with S. Pankavich)
Preprint, **arXiv:2306.11725**, 48 pages

23. Strichartz estimates for the Klein-Gordon equation in a conical singular space
(with F. Cacciafesta, A.-S. de Suzzoni and J. Zhang)
Preprint, **arXiv:2007.05331**, 44 pages

22. A uniform ergodic theorem for degenerate flows on the annulus
(with B. Morisse)
Preprint, **arXiv:1902.06681**, 13 pages

21. Computing Spectra – On the Solvability Complexity Index Hierarchy and Towers of Algorithms
(with M. J. Colbrook, A. C. Hansen, O. Nevanlinna and M. Seidel)
Preprint, **arXiv:1508.03280**, 93 pages

20. The Solvability Complexity Index - Computer Science and Logic Meet Scientific Computing
(with A. C. Hansen, O. Nevanlinna and M. Seidel)
Preprint, https://jbenartzi.github.io/papers/SCI_STOC_Final.pdf, 15 pages

Publications

19. On the complexity of the inverse Sturm-Liouville problem
(with M. Marletta and F. Rösler)
Pure and Applied Analysis (accepted), arXiv:2203.13078, 27 pages

18. Asymptotic Growth and Decay of Two-Dimensional Symmetric Plasmas
(with B. Morisse and S. Pankavich)
Kinetic and Related Models, online first, https://doi.org/10.3934/krm.2023015

17. Computing scattering resonances
(with M. Marletta and F. Rösler)
J. Eur. Math. Soc. (JEMS), online first, https://doi.org/10.4171/jems/1258

16. Global Strichartz estimates for the Dirac equation on symmetric spaces
(with F. Cacciafesta, A.-S. de Suzzoni and J. Zhang)
Forum of Math., Sigma 10(e25), 1-38 (2022)

15. Universal algorithms for computing spectra of periodic operators
(with M. Marletta and F. Rösler)
Numer. Math. 150, 719-767 (2022)

14. A toy model for the relativistic Vlasov-Maxwell system
(with S. Pankavich and J. Zhang)
Kinetic and Related Models 15(3), 341-354 (2022)

13. Computing the sound of the sea in a seashell
(with M. Marletta and F. Rösler)
Found. Comput. Math. (FoCM) 22, 697-731 (2022)

12. Uniform convergence in von Neumann's ergodic theorem in the absence of a spectral gap
(with B. Morisse)
Ergod. Theor. Dyn. Syst. 41(6), 1601-1611 (2021)

11. Weak Poincaré inequalities in the absence of spectral gaps
(with A. Einav)
Ann. Henri Poincaré 21(2), 359-375 (2020)

10. Concentrating solutions of the relativistic Vlasov-Maxwell system
(with S. Calogero and S. Pankavich)
Commun. Math. Sci. 17(2), 377-392 (2019)

9. Arbitrarily large solutions of the Vlasov-Poisson system
(with S. Calogero and S. Pankavich)
SIAM J. Math. Anal. 50(4), 4311-4326 (2018)

8. Instabilities of the relativistic Vlasov-Maxwell system on unbounded domains
(with T. Holding)
SIAM J. Math. Anal. 49(5), 4024-4063 (2017)

7. Moment bounds on the corrector of stochastic homogenization of non-symmetric elliptic finite difference equations (with D. Marahrens and S. Neukamm)
Commun. PDE 42(2), 179-234 (2017)

6. Approximations of strongly continuous families of unbounded operators
(with T. Holding)
Commun. Math. Phys. 345(2), 615-630 (2016)

5. Instabilities in kinetic theory and their relationship to the ergodic theorem
Contemp. Math. 653, 25-40 (2015)

4. New barriers in complexity theory: On The Solvability Complexity Index and Towers of Algorithms
(with A. C. Hansen, O. Nevanlinna and M. Seidel)
C. R. Acad. Sci. 353, 931-936 (2015)

3. On the spectrum of shear flows and uniform ergodic theorems
J. Funct. Anal. 267, 299-322 (2014)

2. Instability of nonsymmetric nonmonotone equilibria of the Vlasov-Maxwell system
J. Math. Phys. 52, 123703, pp. 1-21 (2011)

1. Instability of nonmonotone magnetic equilibria of the relativistic Vlasov-Maxwell system
Nonlinearity 24, 3353-3389 (2011)

Invited Conference Talks

Spectral and Resonance Problems for Imaging, Seismology and Materials Science
Université Reims Champagne-Ardennes, Reims, France (scheduled) November 2023

International Workshop on Operator Theory and its Applications:
1. Special Session on Operator Theory in Elliptic PDEs
2. Special Session on Non-Selfadjoint Operators
University of Helsinki, Helsinki, Finland (scheduled) August 2023

Stability Analysis for Nonlinear PDEs
OxPDE, University of Oxford, Oxford, UK August 2022

Mathematical aspects of the physics with non-self-adjoint operators
Banff International Research Station, Alberta, Canada July 2022

International Workshop on Operator Theory and its Applications: Special Session on Spectral Theory and Differential Operators
Lancaster University, Lancaster, UK (online) August 2021

Modélisation océan-atmosphère
Université de Rennes 1, Rennes, France September 2019

The 23rd Bi-Annual Mini-Workshop in Applied and Computational Mathematics
Hebrew University of Jerusalem, Jerusalem, Israel December 2018

South-West Network in Generalised Solutions for Nonlinear PDEs
Cardiff University, Cardiff, UK September 2017

Montréal Analysis Seminar
McGill University, Montréal, Canada April 2017

Workshop on Hilbert's Sixth Problem
University of Leicester, Leicester, UK May 2016

London Analysis Seminar
University College London, London, UK November 2015

Bath-WIMCS Analysis Day
Cardiff University, Cardiff, UK September 2015

Kinetic and Related Equations
BIRS-CMO, Oaxaca, Mexico July 2015

Complex Analysis & Dynamical Systems VII
Nahariya, Israel May 2015

Microlocal Day 5
Imperial College London, London, UK January 2015

The 10th AIMS Conference on Dynamical Systems, Differential Equations and Applications: Special Session on Kinetic Models
Madrid, Spain July 2014

Mathematical Topics in Kinetic Theory
University of Cambridge, Cambridge, UK June 2013

Complex Analysis & Dynamical Systems VI
Nahariya, Israel May 2013

Probabilistic Methods in Kinetic Theory
CIRM, Luminy, France July 2011

The Seventh IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory
University of Georgia, Athens, GA, USA April 2011

Postdoc Mentoring

Frank Rösler, 2018-2022. Frank received his PhD in 2018 under the supervision of Prof. Patrick Dondl at Durham/Freiburg Universities. Frank was awarded a Marie Skłodowska-Curie Fellowship while in Cardiff. He is now a researcher at the University of Bern.

Junyong Zhang, 2018-2020. Junyong received his PhD in 2011 under the supervision of Prof. Changxing Miao at the Institute of Applied Physics and Computational Mathematics in Beijing. Junyong was awarded a Marie Skłodowska-Curie Fellowship while in Cardiff. He is now a Professor at the Beijing Institute of Technology.

Baptiste Morisse, 2017-2020. Baptiste received his PhD in 2017 under the supervision of Dr Benjamin Texier at Université Paris-Diderot. He now works for Thales.

PhD Students

Alexei Stepanenko, 2018-2022. Alexei's thesis was entitled "Spectral approximation and eigenvalue bounds for differential operators", jointly supervised with Prof. Marco Marletta. Alexei went on to Cambridge University with a Fellowship awarded by the London Mathematical Society.

Thomas Holding, 2012-2016. Thomas' thesis was entitled "Asymptotic Behaviour and Derivation of Mean Field Models" for which I served as a junior doctoral supervisor under Profs. José A. Carrillo and Clément Mouhot. Thomas went on to a postdoctoral position with Prof. Martin Hairer.

Teaching

Cardiff University, Cardiff, Wales, UK ..... Since 2016

Undergraduate & Masters Teaching

- ❑ *Partial Differential Equations* (MA3016), Autumn 2023 (scheduled)
- ❑ *Partial Differential Equations* (MA3016), Autumn 2022
- ❑ *Differential Geometry of Curves and Surfaces* (MA3010), Autumn 2018

Doctoral Teaching

- ❑ *Theory of Partial Differential Equations* (MAGIC058), Autumn 2023 (scheduled)

Course taught via video conferencing at the *MAGIC (Mathematics Access Grid Instruction and Collaboration)* consortium, which is a joint postgraduate teaching centre run between 22 UK universities.

Imperial College London, London, UK 2014-2016

Doctoral Teaching

- ❑ *Dispersive Equations* (taught jointly with Dr Arick Shao), Autumn 2015

Course taught via video conferencing at the *TCC (Taught Course Centre)*, which is a joint postgraduate teaching centre run between the universities of Bath, Bristol, Imperial College, Oxford and Warwick.

University of Cambridge, Cambridge, UK 2011-2014

Doctoral Teaching

- ❑ Supervision of Doctoral PDE course project *"Incompressible flows and the Beale-Kato-Majda criterion"*, 2011-2012
- ❑ Teaching Assistant for Doctoral course *Kinetic Theory*, Autumn 2011

Undergraduate Course Supervisions

- ❑ *Vector Calculus*, Spring 2013
- ❑ *Vector Calculus*, Spring 2012
- ❑ *Numerical Analysis*, Spring 2013
- ❑ *Vectors and Matrices*, Autumn 2012
- ❑ *Methods of Mathematical Physics*, Autumn 2012
- ❑ *Methods of Mathematical Physics*, Autumn 2011

Brown University, Providence, Rhode Island, USA 2006-2011

Undergraduate Teaching

- ❑ *Multivariable Calculus* (MA 0180), Autumn 2010
- ❑ *Multivariable Calculus* (MA 0180), Autumn 2009
- ❑ *Analytic Geometry and Calculus* (MA 0060), Spring 2009
- ❑ *Honors Multivariable Calculus* (MA 0350), Autumn 2008

Sheridan Center Teaching Certificate, Completed May 2008

Undergrduate & Masters Student Supervision

Cardiff University, Cardiff, UK — Since 2016

- ❑ Oliver Nelson: *"The Axiom of Choice and the Banach-Tarski Paradox"*, 2022-2023
- ❑ Ronak Sachin Chavan: *"Human Factors in Process Safety Events"*, Summer 2022
- ❑ Thomas Anquetil: *"Kinetic Theory"*, Summer 2018

Imperial College London, London, UK — 2014-2016

- ❑ Maria del Valle Varo: *"Hilbert's Sixth Problem: From Micro to Macroscopic Descriptions"*, Summer 2016
- ❑ Paul Ramond: *"Landau Damping: Physics vs Mathematics"*, 2015-2016
- ❑ Wei Yu: *"Infinite-dimensional spaces, the spectral theorem and the ergodic theorem"*, Summer 2015
- ❑ Charafeddine Mouzouni: *"Topics in existence, uniqueness and stability of solutions to Vlasov systems in Kinetic Theory"*, Spring 2015

University of Cambridge, Cambridge, UK — 2011-2014

- ❑ Zhuo Min Lim: *"Jeans' Theorem in Kinetic Theory"*, 2013-2014
- ❑ Thomas Holding: *"Instability of the Vlasov-Maxwell system on unbounded domains"*, 2012-2013
- ❑ Luca Calatroni: *"Linear stability and instability of plasmas"*, 2011-2012

Event & Seminar Organisation

Organiser, Intradisciplinary Lecture Series, Cardiff University — 2018-*present*

Co-organiser: South Wales Analysis and Probability Seminar (SWAP)
Cardiff and Swansea Universities — 2018-*present*

Joint organiser of a seminar series alternating between Cardiff and Swansea (3-4 times a year) focusing on analysis and probability with local and external speakers. Website link.

Organiser, Cardiff Informal Analysis & PDE Seminar, Cardiff University — 2017-*present*

Co-Organiser, Cardiff Analysis Online Seminar (CAOS), Cardiff University — 2020-2022

Organiser, Analysis Seminar, Cardiff University — 2019-2020

Workshop Organiser: "Small Scales and Homogenisation (SmaSH)"
Cardiff University — June 2019

Jointly organised (with B. Morisse and F. Rösler) an international workshop with 10 invited speakers and a

total of 40 participants. Website.

Workshop Organiser: "An Analyst, a Geometer and a Probabilist Walk Into a Bar"
Cardiff University June 2018

Jointly organised (with B. Morisse) an international workshop with 11 invited speakers and a total of 40 participants. Website.

Conference Organiser: "The Cauchy Problem in Kinetic Theory: Recent Progress in Collisionless Models"
Imperial College London September 2015

Jointly organised (with M. Hadžić and S. Pankavich) an international conference with 25 invited speakers and a total of 50 participants. Website.

Co-organiser, Analysis Seminar, Imperial College London 2015-2016

Local Organiser: "Mathematical Topics in Kinetic Theory"
University of Cambridge June 2013

Organiser, PDE Seminar, University of Cambridge 2011-2014

Organiser, Informal PDE Seminar, Brown University 2010-2011

Service & Administration

Member of School Ethics Committee, School of Mathematics, Cardiff University 2023-*present*

Special Issue Editor, *Mathematics* (journal) 2020

Editor of special issue "Modern Analysis and Partial Differential Equations".

Member of Internal Review Panel, Cardiff University January 2020

Member of the Round 5 UKRI Future Leaders Fellowships Expression of Interest panel within the College of Physical Sciences and Engineering.

Member of University Senate, Cardiff University 2019-2020

Member of School Research Committee, School of Mathematics, Cardiff University 2019-2021

Postdoc Representative, Department of Mathematics, Imperial College London 2014-2015

Responsible for representing postdocs of the mathematics department to the College, and organising career development and social events.

Grant Refereeing: Czech Science Foundation, UK Engineering and Physical Sciences Research Council, Research Grants Council of Hong Kong, Agence Nationale de la Recherche (France)

Journal Refereeing: Discrete and Continuous Dynamical Systems - Series A, Kinetic and Related Models, Rocky Mountain Journal of Mathematics, Journal of Functional Analysis, SIAM Journal on Mathematical Analysis, Communications in Partial Differential Equations, Communications in Mathematical Physics, Advances in Mathematics, Journal of Differential Equations, Journal of Computational and Applied Mathematics, Proceedings of the London Mathematical Society, Journal of Ocean Engineering and Marine Energy, Proceedings of the Royal Society of Edinburgh, Nonlinearity, Journal de Mathématiques Pures et Appliquées, Mathematische Annalen, Foundations of Computational Mathematics, Journal of Approximation Theory

Reviewer, Mathematical Reviews 2012-*present*

Seminar Talks

2023: Université d'Orléans (scheduled), Université de Tours

2022: University of Bremen, University of Oxford

2019: Université de Rennes, Swansea University, University of Warwick

2018: Hebrew University of Jerusalem

2017: McGill University, Princeton University

2016: University of Crete, University of Leicester, University of Surrey, University of Sussex

2015: University of Bath, Cardiff University, University of Glasgow, Hebrew University of Jerusalem, University College London, Université Aix-Marseille, University of Oxford, University of Reading, University of Warwick

2014: Imperial College London

2013: University of Durham

2012: Université Paris Nord (13), University of Warwick

2011: University of Cambridge, Max Planck Institute Leipzig, University of Oxford, Technion–Israel Institute of Technology, Imperial College London

2010: Columbia University, Brown University

Academic Visits

Hebrew University of Jerusalem, Jerusalem, Israel: December 2018 (one week)

Brown University, Providence, RI, USA: April 2017 (one week), March 2012 (one week)

Durham University, Durham, UK: June 2016 (one month)

Max Planck Institute, Leipzig, Germany: March 2014 (one week), June 2013 (one week), April 2013 (one week), December 2012 (two weeks), April 2012 (one week), February 2012 (one week), January 2012 (one week), December 2011 (one week)

Université Paris 13, Paris, France: November 2012 (one week)

Computer Code

Code for Publication 19 (inverse Sturm-Liouville problem):
https://github.com/jbenartzi/inverse_SCI

Code for Publication 17 (quantum scattering resonances):
https://github.com/jbenartzi/Resonances_SCI_1d

Code for Publication 15 (spectra of periodic operators, 2D):
https://github.com/jbenartzi/PeriodicSpectra2d

Code for Publication 15 (spectra of periodic operators, 1D):
https://github.com/jbenartzi/PeriodicSpectra

Code for Publication 13 (classical scattering resonances):
https://github.com/jbenartzi/SeashellComp

Memberships

London Mathematical Society, member 2014-*present*

American Mathematical Society, member 2018-*present*

Langauge Skills

Hebrew (native), **English** (fluent), **French** (proficient)

Contact Information

School of Mathematics
Cardiff University
Abacws Building
Senghennydd Road
Cardiff CF24 4AG
Wales, United Kingdom

Email: Ben-ArtziJ@cardiff.ac.uk
Webpage: https://jbenartzi.github.io/