Matteo Capoferri

Curriculum Vitae

Department of Mathematics
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Personal data

Date of birth	14 October 1992, in Brescia (Italy)
Nationality	Italian and British

Appointments

Aug 2023 – to date	**Associate Professor**, *Department of Mathematics*, Heriot-Watt University, Edinburgh, UK
Sept 2022 – Jul 2023	**Assistant Professor**, *Department of Mathematics*, Heriot-Watt University, Edinburgh, UK
Aug 2021 – to date	**Honorary Reader (Associate Professor)**, *Department of Mathematics*, University College London, UK
Mar 2020 – Aug 2022	**Research Associate in Mathematical Analysis**, *School of Mathematics*, Cardiff University, UK
Sept 2016 – Mar 2020	**Teaching Assistant in Pure Mathematics**, *Department of Mathematics*, University College London, UK, (25% of time devoted to departmental teaching, in parallel to PhD studies)

Education

Sept 2016 – June 2020	**PhD in Mathematics**, *Department of Mathematics*, University College London, UK
	Thesis: *Microlocal analysis of global hyperbolic propagators on manifolds without boundary* (Supervisor: Prof Dmitri Vassiliev – Examiners: Prof Ari Laptev and Prof Alex Sobolev)
2014 – 2016	**MSc in Theoretical Physics**, *University of Pavia*, Italy
	Thesis: *Algebra of observables and states for quantum Abelian duality*
	Final mark: 110/110 *summa cum laude*
2011 – 2014	**BSc in Physics**, *University of Pavia*, Italy
	Thesis: *Time observable in non-relativistic quantum mechanics*
	Final mark: 110/110 *summa cum laude*
2017, May 9	**Second Level University Diploma**, *Institute for Advanced Study (IUSS)*, Pavia, Italy
2014, Oct. 17	**First Level University Diploma**, *Institute for Advanced Study (IUSS)*, Pavia, Italy
2011 – 2016	**Fellow**, *Almo Collegio Borromeo & Institute for Advanced Study*, Pavia, Italy

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Publications and preprints

Preprints:

[18.] **On boundary conditions for linearised Einstein's equations**
Submitted
(with S. Murro and G. Schmid)

[17.] **High-contrast random systems of PDEs: homogenisation and spectral theory**
ArXiv:2312.09046 [math.AP] (2023)
(with M. Cherdantsev and I. Velčić)

[16.] **Beyond the Hodge theorem: curl and asymmetric pseudodifferential projections**
ArXiv:2309.02015 [math.DG] (2023)
(with D. Vassiliev)

Publications:

[15.] Spectral asymptotics for linear elasticity: the case of mixed boundary conditions
Proceedings of the Royal Society of Edinburgh. Section A: Mathematics, to appear
(with I. Mann)

[14.] Global and microlocal aspects of Dirac operators: propagators and Hadamard states
Advances in Differential Equations, to appear
(with S. Murro)

[13.] Eigenfunctions localised on a defect in high-contrast random media
SIAM Journal on Mathematical Analysis, to appear
(with M. Cherdantsev and I. Velčić)

[12.] Two-term spectral asymptotics in linear elasticity
Journal of Geometric Analysis **22** (2023) 242
(with L. Friedlander, M. Levitin and D. Vassiliev)

[11.] Topological obstructions to the diagonalisation of pseudodifferential systems
Proceedings of the American Mathematical Society (Ser.B) **9** (2022) 472–486.
(with G. Rozenblum, N Saveliev and D. Vassiliev)

[10.] Diagonalization of elliptic systems via pseudodifferential projections
Journal of Differential Equations **313** (2022) 157–187

[9.] Partial differential equations and quantum states in curved spacetimes
Mathematics **9** no. 16 (2021) 1936
(with Z. Avetisyan)

[8.] Invariant subspaces of elliptic systems II: spectral theory
Journal of Spectral Theory **12** no. 1 (2022) 301–338
(with D. Vassiliev)

[7.] Invariant subspaces of elliptic systems I: pseudodifferential projections
Journal of Functional Analysis **282** no. 8 (2022) 109402
(with D. Vassiliev)

[6.] Global propagator for the massless Dirac operator and spectral asymptotics
Integral Equations and Operator Theory **94** (2022) 30
(with D. Vassiliev)

[5.] Global wave parametrices on globally hyperbolic spacetimes
Journal of Mathematical Analysis and Applications **490** (2020) 124316
(with C. Dappiaggi and N. Drago)

[4.] Geometric wave propagator on Riemannian manifolds
Communications in Analysis and Geometry **30** no. 8 (2022) 1713–1777
(with M. Levitin and D. Vassiliev)

[3.] Classification of first order sesquilinear forms
Reviews in Mathematical Physics **32** (2020) 2050027
(with N. Saveliev and D. Vassiliev)

[2.] Spacetime diffeomorphisms as matter fields
Journal of Mathematical Physics **61** (2020) 111508
(with D. Vassiliev)

[1.] Hadamard States for Quantum Abelian Duality
Annales Henri Poincaré **18** no. 10 (2017) 3325–3370
(with M. Benini and C. Dappiaggi)

In preparation:

[P1.] Noncommutative Gelfand duality: the algebraic case
(with F. Bambozzi and S. Murro)

[P2.] Higher order Weyl coefficients for the operator curl
(with G. Bracchi and D. Vassilev)

[P3.] A microlocal pathway to spectral asymmetry: curl and the eta invariant
(with D. Vassilev)

[P4.] Spectral asymmetry via pseudodifferential projections: the massless Dirac operator
(with B. Costeri and C. Dappiaggi)

Scientific Interests

Mathematics	Microlocal analysis, spectral theory, homogenisation of stochastic PDEs, geometric analysis.
Mathematical Physics	Quantum field theory, spectral properties of random materials, general relativity, mathematical elasticity.

Awards, Grants and Scholarships

Research grants and funding:

2026	**Isaac Newton Institute 6-Month Programme on "Geometric Spectral Theory"**, *(Programme organiser & co-applicant)*, Isaac Newton Institute, Cambridge
2024	**ICMS Research-in-Group project**, *£7,000 (Co-I, with S. Murro and F. Bambozzi)*, International Centre for Mathematical Sciences, Edinburgh
2024	**LMS Research Grant (Scheme 9)**, *£500 (Principal Investigator)*, London Mathematical Society
2023	**Learning & Research Support Fund**, *£3,000 (Principal Investigator)*, Glasgow Mathematical Journal Trust
2023	**ICMS Conference Grant**, *£24,000 (Principal Investigator)*, International Centre for Mathematical Sciences, Edinburgh
2023–2026	**EPSRC Fellowship**, *~£400k (Principal Investigator, Personal Award)*, UKRI
2023–2025	**INI Network Support for the Mathematical Sciences**, *£25,000 (PI/Lead Applicant)*, Isaac Newton Institute
2022–2023	**Heilbronn/EPSRC Small Grant**, *£2,000 (Principal Investigator)*, Heilbronn Institute for Mathematical Research
2022–2024	**Junior Visiting Position**, *2-year fellowship (€66,548)*, De Giorgi Centre, Scuola Normale Superiore, Pisa (Italy) [Declined to take up a permanent post]
2021	**LMS Research Grant – Scheme 4**, *£600 (Principal Investigator)*, London Mathematical Society
2020	**Clay Mathematics Institute – Conference grant**, *$5000 (with D. Vassiliev and C. Garetto)*
2020	**LMS Research Grant – Scheme 4**, *£600 (Principal Investigator)*, London Mathematical Society
2019	**LMS Research Grant – Scheme 1**, *£6,000 (with D. Vassiliev and C. Garetto)*, London Mathematical Society
2018	**Springer Fellowship**, Canadian Mathematical Society

Awards:

2021	**Dean's Commendation**, Faculty of Mathematical and Physical Sciences, UCL "For the outstanding performance in the PhD in Mathematics"
2019	**MAPS Faculty Teaching Award**, UCL
2018	**Davenport Prize for Pure Mathematics**, UCL
2017	**Grazioli Prize**, Istituto Lombardo Accademia di Scienze e Lettere *For the best MSc thesis in the Lombardy region.*
2016	**Comini Prize**, Almo Collegio Borromeo
2015	**Vincenzi Prize**, Almo Collegio Borromeo

Scholarships:

2019	**Archibald Richardson Scholarship for Pure Mathematics**, UCL
2018	**Sir George Jessel Scholarship**, UCL
2016 – 2020	**PhD Scholarship**, UCL
2011 – 2016	**Five-year IUSS Scholarship**, Institute for Advanced Study, Pavia

Teaching

Recipient of the 2019 MAPS Faculty Teaching Award, UCL

Nominated for the 2019 Inspiring Teaching Delivery Award, UCL

Heriot-Watt University Lecturer and Course Leader for the PhD Course "Functional Analysis", Scottish Mathematical Sciences Training Centre (SMSTC) (2023/24)

Lecturer/Global Course Leader for Discrete Mathematics (2022/2023)

Other TA for the course *Spectral theory of Hilbert spaces*, Séminaires de Mathématiques Supérieures 2021 "Microlocal analysis: theory and applications", CRM, Montréal. (Spring 2021)

Cardiff University Lecturer for Part II of the LMS-funded minicourse for PhD students "An introduction to algebraic quantum field theory on curved spacetime" (Oct. 2020)

LSE Class Teacher for ME306 *Real Analysis*, London School of Economics Summer School (2019)

UCL Lecturer for Mathematical Methods in Chemistry (2018/2019, 2019/2020)

Replacement lecturer for Analysis 2 and Analysis 4 (2018/2019)

Co-supervision of summer projects (2018/2019)

Problem class teacher for Analysis 1 (2017/2018) Analysis 4 (2017/2018), Mathematics for Science 2 (2017/2018)

Demonstrator for Analysis 1 (2016/2017) and Analysis 4 (2016/2017, 2017/2018, 2018/2019)

Examiner for Analysis 1, Analysis 4, Complex Analysis, Mathematics for Science 2, Mathematical Methods in Chemistry

Tutorials in Pure Mathematics (2016/2017, 2017/2018)

Short Visits

May 30– June 9 2024	**Prof Igor Velcic**, *University of Zagreb (Croatia)*
May 3–10 2024	**Prof Claudio Dappiaggi**, *University of Pavia (Italy)*
Jan 10–12 2024	**Prof Claudio Dappiaggi**, *University of Pavia (Italy)*
Dec 17–22 2022	**Dr Simone Murro**, *University of Genova (Italy)*
Nov 14–18 2022	**Prof Peter Bella**, *TU Dortmund (Germany)*
May 15–22 2022	**Prof Igor Velcic**, *University of Zagreb (Croatia)*
Mar 7–11 2022	**Prof Dmitri Vassiliev**, *University College London (UK)*
Jul 21–24 2021	**Prof Dmitri Vassiliev**, *University College London (UK)*
Dec 10–12, 2020	**Prof Dmitri Vassiliev**, *University College London (UK)*
Jun 3–6, 2019	**Dr Marcello Seri**, *University of Groningen (Netherlands)*
Jan 7–10, 2019	**Prof Claudio Dappiaggi**, *University of Pavia (Italy)*
Nov 5–9, 2018	**JProf Nadine Große & Dr Simone Murro**, *University of Freiburg (Germany)*
May 29–Jun. 1, 2018	**Prof Claudio Dappiaggi**, *University of Pavia (Italy)*
Oct. 2–6, 2017	**Prof Claudio Dappiaggi**, *University of Pavia (Italy)*
Apr. 3–16, 2016	**Prof Christian Bär & Dr Marco Benini**, *Institut für Mathematik - Universität Potsdam (Germany)*

Talks and seminars

September, 2024	Conference "International Conference on Generalized Functions", Torino, Italy (**Invited**)
July, 2024	LMS–INI–Bath Mathematical Symposium "Advances in Spectral Theory", Bath, UK (**Invited**)
March, 2024	Conference "Analysis on fractals and networks", Luminy, Marseille, France (**Invited**)
January, 2024	Analysis Seminar, Durham University, UK (**Invited**)
January, 2024	Conference "Common trends and challenges in QFT and stochastic PDEs", Pavia, Italy (**Invited**)
November 7, 2023	Analysis Seminar, University of Strathclyde, Glasgow UK (**Invited**)
July 24, 2023	LMS–Bath Symposium, Bath, UK (**Invited**)
June 23, 2023	Paris–London Analysis Seminar, Institut Henri Poincaré, Paris (**Invited**)

June 19, 2023	Analysis Seminar, Bath, UK (**Invited**)
May 9, 2023	Spectral Geometry and Applications, Québec City, Canada (**Invited**)
April 18, 2023	Analysis Seminar, Queen Mary University of London, UK (**Invited**)
December 19, 2022	Mathematical Physics Seminar, University of Genova, Italy (**Invited**)
November 16, 2022	Analysis & PDE Seminar, TU Dortmund, Germany (**Invited**)
October 21, 2022	Oberwolfach Arbeitsgemeinschaft, Germany
July 13, 2022	Maxwell Analysis Seminar, Edinburgh, UK (**Invited**)
July 7, 2022	Conference "The Dirac Equation", Bordeaux, France (**Invited**)
June 20, 2022	Conference "Analysis, PDEs and Applications", Dubrovnik, Croatia
June 15, 2022	Workshop "Harmonic analysis and partial differential operators", Loughborough, UK (**Invited**)
May 25, 2022	Workshop on Hyperbolic PDEs and related topics, Queen Mary University of London, UK (**Invited**)
Mar 24, 2022	Applied PDEs Seminar, Imperial College London, UK (**Invited**)
Aug, 2021	IWOTA, Special Session on "Spectral Theory and Differential Operators", University of Lancaster, UK (**Invited**)
Jun 10, 2021	Analysis Seminar, University of Oldenburg, Germany (**Invited**)
May 25, 2021	IFS Seminar, Armenia (**Invited**)
May 5, 2021	Analysis Seminar, Loughborough University, UK (**Invited**)
Feb 17, 2021	Analysis Seminar, University of Leeds, UK (**Invited**)
Aug, 3 2020	Online conference "Young Researchers in Spectral Geometry", CRM, Montreal, Canada (**Invited**)
May 28, 2020	Conference "Scattering, microlocal analysis and renormalization", Institut Mittag-Leffler, Sweden (**Invited**)
Apr 6, 2020	Analysis Seminar, Cardiff University, UK (**Invited**)
Feb 3, 2020	Conference on Spectral Theory and Mathematical Physics, Sochi, Russia (**Invited**)
Nov 7, 2019	Mathematical Physics Seminar, University of York, UK (**Invited**)
Sep 30, 2019	Analysis & PDE Seminar, University of Sussex, UK (**Invited**)
Sep 10, 2019	Workshop on Spectral Geometry and Analysis of Differential Operators, University of Padova
Jun 4, 2019	Mathematics Colloquium, University of Groningen, Netherlands (**Invited**)
May 10, 2019	Junior Analysis Seminar, Imperial College London (**Invited**)
Mar 4, 2019	UK Meeting on Hyperbolic Equations, Loughborough University, UK (**Invited**)
Nov 5, 2018	Differential geometry seminar, University of Freiburg, Germany (**Invited**)
Jul 21, 2018	YRS, International Congress of Mathematical Physics, Montreal, Canada
Jul 6, 2018	Conference "Microlocal and time-frequency analysis", Turin, Italy
Jun 28, 2018	Conference "An analyst, a geometer and a probabilist walk into a bar", Cardiff, UK
Jun 11, 2018	Conference "10th Birman Conference on Spectral Theory", Saint Petersburg, Russia (**Invited**)
Jun 5, 2018	Conference "AQFT: Where operator algebra meets microlocal analysis", Cortona, Italy
May 30, 2018	Mathematical Physics Seminar, University of Pavia, Italy (**Invited**)
Feb 1, 2018	41^s LQP Workshop, Mathematisches Institut, Göttingen, Germany
Aug 28, 2017	Conference "Geometric Foundations of Gravity", University of Tartu, Estonia

Academic service

2023 – 2025	Chair of the Organising Committee, UK Spectral Theory Network (funded by the INI)
2023 – to date	Member of the EPSRC Peer Review College *(Pool of reviewers of EPSRC/UKRI grant proposals)*
Jan 2018 – now	Reviewer for AMS Mathematical Reviews
	Referee for *Inventiones Mathematicae*, *Journal of Differential Equations*, *Pure and Applied Analysis*, *Communications on Pure and Applied Analysis*, *Communications in Mathematical Physics*, *Annales Henri Poincaré*, *Letters in Mathematical Physics*, *Journal of Mathematical Physics*, *Differential Geometry and its Applications*

Referee for the *Springer Nature* sciences books

External PhD examiner (2024, University of Genova)

Organisation of conferences and workshops:

January–June 2026	Organiser of a six-month programme in *Geometric Spectral Theory*, Isaac Newton Institute, Cambridge (with F. Cakoni, A. Hassannezhad, M. Levitin, I. Polterovich, Z. Rudnick)
September 2024	Workshop on *Spectral Theory*, Edinburgh (with S. Boegli, J.-C. Cuenin, K. Gittins)
April 2024	Workshop on *Inverse Problems and Applications*, UCL (with D. Vassiliev)
February 2024	Workshop *Microlocal Analysis and PDEs: advances and perspectives*, Maxwell Institute for Mathematical Sciences, Edinburgh
September 2023	Workshop on *Spectral Theory*, Bristol (with A. Hassannezhad, M. Karpukhin, J. Lagacé)
July 2022	Workshop on *Microlocal Analysis and PDEs*, UCL (with C. Garetto and D. Vassiliev)

Departmental service:

2023 – now	Organiser of the Analysis Seminar, Heriot-Watt University
Jan 2022 – Aug 2022	Member of the Research Committee, School of Mathematics, Cardiff University
Aug 2020 – Aug 2022	Organiser of the Analysis & PDE Seminar, Cardiff University
Oct 2017 – Feb 2020	Webmaster of the London Analysis website and mailing list