

Matteo Capoferri

Curriculum Vitae

Department of Mathematics
Heriot-Watt University
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Personal data

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

Current position

From Sept 2024 **Professore Associato (MATH-03/A – Analisi Matematica)**
Department of Mathematics, University of Milan (Italy)
From Aug 2023 **Associate Professor**
Department of Mathematics, Heriot-Watt University (Edinburgh, UK)

Appointments

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)

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

Publications and preprints

Preprints:

- [18.] **High-contrast random systems of PDEs: homogenisation and spectral theory**
ArXiv:2312.09046 [math.AP] (2023)
(with M. Cherdantsev and I. Velčić)
- [17.] **Beyond the Hodge theorem: curl and asymmetric pseudodifferential projections**
ArXiv:2309.02015 [math.DG] (2023)
(with D. Vassiliev)

Publications:

- [16.] **On boundary conditions for linearised Einstein's equations**
Applied Mathematics Letters **158** (2024) 109210
(with S. Murro and G. Schmid)
- [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 **55** no. 6 (2023) 7449–7489
(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)

Other published work:

- [O1.] **Homogenisation of the wave equation for long times**
In: "Arbeitsgemeinschaft: Quantitative Stochastic Homogenization" (A. Gloria and F. Otto Eds.)
Oberwolfach Reports **48** (2022) 62–64
(with M. Cherdantsev and I. Velčić)

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
- 2025 **Learning & Research Support Fund**, £3,000 (*co-I, with D. Johnston and L. Banjai*), Glasgow Mathematical Journal Trust
- 2025 **Heilbronn Small Grant**, £5,000 (*co-I, with D. Johnston and L. Banjai*), Heilbronn Institute for the Mathematical Sciences
- 2025 **LMS Research School Grant**, £15,000 (*co-I, with D. Johnston and L. Banjai*), London Mathematical Society
- 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*, *Journal of the London Mathematical Society*, *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:

- 2024 Maxwell Institute Research Theme Convenor for Analysis and Probability
- 2024 Member of the Research Committee (Mathematical Sciences), Heriot-Watt University
- 2023 – now Member of hiring panels for PhD students and Postdocs
- 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