

# 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

### 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:*

- [21.] **A microlocal pathway to spectral asymmetry: curl and the eta invariant**  
ArXiv:2502.18307 [math.SP] (2025)  
(with D. Vassilev)
- [20.] **Quantitative estimates for high-contrast random media**  
ArXiv:2502.09493 [math.AP] (2025)  
(with P. Bella, M. Cherdantsev and I. Velčić)

- [19.] **Noncommutative Gelfand duality: the algebraic case**  
ArXiv:2411.11816 [math.AG] (2024)  
(with F. Bambozzi and S. Murro)
- [18.] **Beyond the Hodge theorem: curl and asymmetric pseudodifferential projections**  
ArXiv:2309.02015 [math.DG] (2023)  
(with D. Vassiliev)

*Publications:*

- [17.] **High-contrast random systems of PDEs: homogenisation and spectral theory**  
*Communications in Contemporary Mathematics*, to appear  
(with M. Cherdantsev and I. Velčić)
- [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.] **Higher order Weyl coefficients for the operator curl**  
(with G. Bracchi and D. Vassilev)
- [P2.] **Spectral asymmetry via pseudodifferential projections: the massless Dirac operator**  
(with B. Costeri and C. Dappiaggi)

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## 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.

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## 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 **Heilbronn Small Grant**, £5,000 (*PI, with K. Gittins and L. Provenzano*), Heilbronn Institute for the Mathematical Sciences
- 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

**University of Milan** Lecturer for “Mathematics” (BSc in Medical Biotechnologies) and “Mathematics” (MSc in Pharmaceutical Chemistry and Technology) (2024/25)

**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)

## Extended visits

Mar 24 – Apr 17 2025 **Visiting Associate Professor**, Department of Mathematics, Yale University (USA)

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## 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)*

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## 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<sup>s</sup> LQP Workshop, Mathematisches Institut, Göttingen, Germany
- Aug 28, 2017 Conference "Geometric Foundations of Gravity", University of Tartu, Estonia

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## 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  
**Reviewer** of grant applications for UKRI/EPSRC (UK Research Council), NWO (Dutch Research Council)  
**External PhD examiner** (2024, University of Genova; 2025, University of Torino)  
  
*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