

# Simone Murro

## Curriculum Vitae

Department of Mathematics  
University of Genova  
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### Academic Positions

- Assistant Professor, University of Genova, Italy 02/2021 – present
- Research fellowship, University of Paris-Saclay, France 10/2020 – 01/2021
- Postdoc position, University of Trento, Germany 10/2019 – 09/2020
- Postdoc position, University of Freiburg, Germany 08/2017 – 09/2019
- Postdoc position, University of Regensburg, Germany 07/2017 – 04/2017

### Education

- Ph.D. in Mathematics, University of Regensburg, Germany 04/2014 – 04/2017  
Advisor: Felix Finster      Coadvisor: Claudio Dappiaggi  
Thesis title: *Quantum states on the algebras of Dirac fields*
- M.S. in Mathematical Physics, University of Pavia, Italy 10/2011 – 10/2013
- B.S. in Physics, University of Pavia, Italy 10/2007 – 04/2011

### Awards, Grants and Fellowship

- *Abilitazione scientifica nazionale (Italian habilitation)* 06/2021 – 05/2032
- *Fellowship INFN*, sect. Genova 01/2023 – 12/2024
- *PI INdAM grant*, “Feynman propagator for Dirac fields” 01/2023 – 12/2023
- *PI DFG Reserch grant*, “Hadamard states in Linearized Quantum Gravity” 10/2020 – 01/2022
- *Fellowship INFN*, sect. Trento 10/2019 – 09/2020
- *DFG Fellowship*, GRK 1821 “Cohomological Methods in Geometry” (2017-2019) 08/2017 – 09/2019
- *Fellowship CRM*, Applied Mathematics Laboratory (07/2018) 07/2018
- *PI Short-visit grant*, COST Action MP 1405 (11/2015) 11/2015
- *DFG Fellowship*, GRK 1692 “Curvature, Cycles, and Cohomology” (2014-2017) 04/2014 – 03/2017

### Publications

18. “On the Cauchy problem for the Fadaray tensor on globally hyperbolic manifolds with timelike boundary” to appear on *Rendiconti Lincei Matematica e Applicazioni* (with N. Drago and N. Ginoux)
17. “Global and microlocal aspects of Dirac operators: propagators and Hadamard states” to appear on *Advances in Differential Equations* (with M. Capoferri)
16. “The quantization of Proca fields on globally hyperbolic spacetimes: Hadamard states and Møller operators” *Annales Henri Poincaré* (2023) vol 24: 3055-3111 (with V. Moretti and D. Volpe)
15. “Paracausal deformations of Lorentzian metrics and Møller isomorphisms in algebraic quantum field theory” *Selecta Mathematica New Series* vol 29: 56 (with V. Moretti and D. Volpe)
14. “Møller operators and Hadamard states for Dirac fields with MIT boundary conditions” *Documenta Mathematica* (2022) vol 27: 1693-1737 (with N. Drago and N. Ginoux)

13. "On the Cauchy problem for Friedrichs systems on globally hyperbolic manifolds with timelike boundary" *Advances in Differential Equations* (2022) vol 27: 497-542 (with N. Ginoux)
12. "Injective tensor products in strict deformation quantization" *Mathematical Physics, Analysis and Geometry* (2022) vol 25: 2 (with C.J.F. van de Ven)
11. "Intertwining operators for symmetric hyperbolic systems on globally hyperbolic manifolds" *Annals of Global Analysis and Geometry* (2021) vol 59: 1-25 (with D. Volpe)
10. "On the uniqueness of invariant states" *Advances in Mathematics* (2021) vol 376: 107445 (with F. Bambozzi)
9. "The well-posedness of the Cauchy problem for the Dirac operator on globally hyperbolic manifolds with timelike boundary" *Documenta Mathematica* (2020) vol 25: 737-765 (with N. Große)
8. "The Fermionic Signature Operator in De Sitter Spacetime" *Journal of Mathematical Analysis and Applications* (2020) vol 485: 123808 (with C. Dappiaggi, F. Finster and E. Radici)
7. "Invariant states on noncommutative tori" *International Mathematics Research Notices* (2019) vol 2021: 3299-3313 (with F. Bambozzi and N. Pinamonti)
6. "A new class of Fermionic Projectors: Møller operators and mass oscillation properties" *Letters in Mathematical Physics* (2017) vol 117: 2433–2451 (with N. Drago)
5. "The Fermionic Signature Operator and Quantum States in Rindler Space-time" *Journal of Mathematical Analysis and Applications* (2017) vol 454: 385-411, (with F. Finster and C. Röken)
4. "Non-existence of natural states for Abelian Chern-Simons theory" *Journal of Geometry and Physics* (2017) vol 116: 119-123 (with C. Dappiaggi and A. Schenkel)
3. "Wavefront sets and polarizations on supermanifolds" *Journal of Mathematical Physics* (2017) vol 58: 023504 (with C. Dappiaggi, H. Gimperlein and A. Schenkel)
2. "The fermionic projector in a time-dependent external potential: mass oscillation property and Hadamard states" *Journal of Mathematical Physics* (2016) vol 57: 072303 (with F. Finster and C. Röken)
1. "Radiative observables for linearized gravity on asymptotically flat spacetimes and their boundary induced states" *Journal of Mathematical Physics* (2014) vol 55: 082301 (with M. Benini and C. Dappiaggi)

## Pre-print

4. "The Quantization of Maxwell Theory in the Cauchy Radiation Gauge: Hodge Decomposition and Hadamard States" arXiv:2401.08403 [math.AP] (2024) (with G. Schmid)
3. "The five gradients inequality on differentiable manifolds " arXiv:2307.11451 [math.AP] (2023) (with S. Di Marino and E. Radici)
2. "Wick rotation of linearized gravity in Gaussian time and Calderón projectors" arXiv:2204.01094 [math-ph] (2022) (with C. Gérard and M. Wrochna)
1. "The Cauchy problem of the Lorentzian Dirac operator with APS boundary conditions" arXiv:2104.00585 [math.AP] (2021). (with N. Drago and N. Große)

## Research Talks

- *Hadamard states for Maxwell fields via complete gauge fixing*

Seminar: "Seminar über Mathematische Physik", University of Regensburg	11/2023
Seminar: "Heriot-Watt Analysis Seminar", Maxwell Institute, Edinburgh	10/2023
Conference: "Spectral Theory and Mathematical Relativity", ESI Vienna	07/2023
- *Paracausal deformations of Lorentzian metrics and their consequences in QFT*

Seminar: "Séminaire de Geometrie differentielle"	10/2021
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- *On the Cauchy problem for Friedrichs systems on Lorentzian manifolds*  
Seminar: “Quantum fields interacting with geometry” Institut Henri Poincaré 11/2020  
Seminar: “Forschungsseminar Differentialgeometrie” University of Potsdam 10/2020  
Seminar: “Seminar über Mathematische Physik”, University of Regensburg 07/2020  
Conference: “Cross-diffusion systems, gradient flows, and their perturbations” 04/2019
- *On the Cauchy problem for the Dirac operators on Lorentzian spin manifolds*  
Conference: “Journées nancéiennes de géométrie” Nancy 12/2018  
Seminar: “Seminario di Fisica Matematica” University of Genova 02/2018  
Seminar: “Seminar über Mathematische Physik”, University of Regensburg 11/2017
- *Linearized gravity and Hadamard states*  
Seminar: “Séminaires Math-Physique” University of Bourgogne 07/2017
- *Is there a natural states for Abelian Chern-Simons theory?*  
Seminar: “Seminario di Fisica Matematica” University of Roma 3 09/2017  
Seminar: “Seminario di Fisica Matematica” University of Genova 07/2017  
Workshop: “Foundational and structural aspects of gauge theories” 03/2017
- *Invariant states on Weyl algebras for the action of the symplectic group*  
Conference: “Young Researchers Symposium at ICMP” 07/2018  
Workshop: “AQFT: where operator algebra meets microlocal analysis” 05/2018
- *A taste of microlocal analysis on supermanifolds*  
Workshop: “Microlocal analysis: a tool to explore a quantum world” Genova 07/2017
- *Hadamard states for quantum Dirac fields*  
Seminar: “Coloquio de Matemática UC” Universidad Catolica de Chile 11/2016  
Seminar: “Seminario de Teoria Espectral” Universidad Catolica de Chile 10/2016  
Seminar: “Münchner Mathematische” LMU Munich 07/2016  
Seminar: “Seminars of Mathematical Physics” Heriot-Watt University 10/2015  
Seminar: “Seminario di Fisica Matematica” University of Genova 04/2015  
Seminar: “Seminario di Fisica Matematica” University of Pavia 11/2014

## Conference and Workshop organization

- *Algebraic and Geometric Aspects in Quantum Field Theory*  
Workshop at the University of Freiburg, 16–18 April 2019
- *Analysis of Differential Operators on Manifolds*  
Workshop at the University of Freiburg, 24–26 September 2018

## Teaching Experiences

- Teaching Assistant for “Meccanica Analitica” at the University of Genova  
degree in Mathematics: Su.Se. 2022 ,Su.Se. 2023, Su.Se. 2024  
degree in Physics: Su.Se. 2024
- Teaching Assistant for “Meccanica Matematici della Relatività Generale” at the University of Genova  
degree in Mathematics , Wi.Se. 2022, Wi.Se. 2023

- Chair for “Fisica Matematica 1” at the University of Genova  
degree in Engineering: Wi.Se. 2022, Wi.Se. 2023
- Teaching Assistant for “Fisica Matematica 2” at the University of Genova  
degree in Engineering: Su.Se. 2022
- Responsible for “Operator Algebras and Quantum Field Theory” at the University of Freiburg  
degree in Mathematics: Wi.Se. 2018
- Responsible for “Operator Algebras and Quantum Mechanics” at the University of Freiburg  
degree in Mathematics: Su.Se. 2018
- Chair of “Milrolocale Analysis” at the University of Freiburg  
degree in Mathematics: Wi.Se. 2017
- Teaching Assistant for “Analysis II für Physiker” at the University of Regensburg  
degree in Physics: Su.Se. 2017
- Tutor for “Fisica per Biologi” at the University of Regensburg  
degree in Biology: Su.Se. 2013

## Mentoring

- Gabriel Schmid (10.2022 – )  
Ph.D. candidate at the University of Genoa
- Daniele Volpe PhD. students at the University of Trento from 10.2019 – 07.2023)  
Ph.D. Thesis: Paracausal deformations, geometric Møller operators and Hadamard states  
co-supervised with Prof. Valter Moretti
- Caterina Tavelli – Bachelor student in 2023 at the University of Genova  
Thesis: Il sistema di Lorenz: un modello matematico per la convezione atmosferica
- Chiara Poggi – Bachelor student in 2023 at the University of Genova  
Thesis: Stima del Wave Front Set per campi di Klein-Gordon  
Co-supervised with Nicola Pinamonti

## References

- Prof. Dr. C. Dappiaggi : *Dipartimento di Fisica, Università di Pavia*  
email: claudio.dappiaggi@unipv.it
- Prof. Dr. F. Finster: *Fakultät für Mathematik, Universität Regensburg*  
email: finster@ur.de
- Prof. Dr. C. Gérard: *Département de Mathématiques, Université Paris-Saclay*  
email: christian.gerard@math.u-psud.fr
- Prof. Dr. V. Moretti: *Dipartimento di Matematica, Università di Trento*  
email: valter.moretti@unitn.it