

# Nicolò Drago

## Curriculum Vitae\*

### Personal data

**Personal data:** Male, born in Genova (Italy) 1989.11.01; Nationality: Italy.

**Home address:** Via Molassana 15/18; 16138 Genoa, Italy.

**Email:** nicolo.drago@unitn.it

### Current position

2021 **Assistant Professor (RTD)** at the Department of Mathematics, University of Trento.

(Italy, 2021.02.01 - ongoing)

### Working Experiences and Fellowships

2019 **von Humboldt Fellow** at Institut für Mathematik, University of Würzburg.

(Germany, 2019.10.01 - 2021.01.31)

2018 **Post-doctoral position** at the Department of Mathematics, University of Trento.

(Italy, 2018.11.01 - 2019.09.30)

2017 **Post-doctoral position** at the Department of Physics, University of Pavia.

(Italy, 2017.01.01 - 2018.10.31)

Project: *Aspetti strutturali della teoria dei campi su spaziotempi curvi.*

Head of the project: Prof. C. Dappiaggi.

### Education and training

2017 Ph.D. in Mathematics at Università degli Studi di Genova.

(Italy, 2014.01.01 - 2017.02.22)

Thesis title: *Perturbative methods in Algebraic QFT with applications to Thermal Field Theory.*

Discussed in Genoa, Italy (2017.02.22).

Advisor: Prof. Nicola Pinamonti.

2013 MSc in Mathematics at Università degli Studi di Genova.

(Italy, 2011.09 - 2013.07)

Thesis title: *The influence of quantum fields on the geodesic path.*

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\*Last updated on December 2021.

Discussed in Genoa, Italy (2013.07.24).

Advisor: Prof. Nicola Pinamonti.

Marks: 110 / 110 cum laude.

2011 BSc in Mathematics at Università degli Studi di Genova.

(Italy, 2008.09 - 2011.09)

Thesis title: *The problem of vibrating string in one spatial dimension.*

Discussed in Genoa, Italy (2011.09.28).

Advisor: Prof. Franco Caviglia.

Marks: 110 / 110 cum laude.

2008 Italian High School diploma at the Liceo Scientifico Statale “Leonardo da Vinci”.

(Genoa, Italy, 2003-2008).

School-leaving examination mark: 98/100.

## Awards and Honors

2021 National Scientific Qualification (Italian Habilitation) as Associate Professor in Mathematical Physics (MAT07, ASN 2018-20).

2019 Qualification aux fonctions de Maître de conférences, pour la section 25 (Mathématiques).

\* Qualification aux fonctions de Maître de conférences, pour la section 26 (Mathématiques appliquées et applications des mathématiques).

2018 von Humboldt research fellowship for postdoctoral researchers.

Project: *Phase transitions and Poisson geometry.*

2017 Erasmus Plus Grant 2017 (KA 103).

This grants were used for a one week series of lectures at Julius Maximilian University of Würzburg (Germany) 2017.10.09-13;

\* Principal investigator in GNFM-INdAM research project

Project: *Wave propagation on Lorentzian manifolds with boundaries and applications to Algebraic QFT.*

Funded by GNFM (Gruppo Nazionale di Fisica Matematica) within the funds reserved for young researchers (Progetto Giovani) for the year 2017. In collaboration with Dr. H. Ferreira.

2016 Cassini project, financed by the Embassy of France in Italy.

This grants were used to organize the *Microlocal Analysis: a tool to explore the Quantum World* Workshop, held at Department of Mathematics of Università degli Studi di Genova (2017.01.12-13);

## Visiting positions in other scientific Institutions

2019 Research in pairs in Oberwolfach R1842,

MFO, Oberwolfach Research Institute for Mathematics (Germany),

2019.03.17-30 .

2016 visit to prof. C. Gérard,

Département de Mathématiques d'Orsay Université de Paris-Sud, Paris (France),

2015.09.13 - 2016.03.13 .

2015 visit to prof. K. Fredenhagen,  
 DESY, Hamburg (Germany),  
 2015.03.15-29 .

## Preprints

1. *Møller operators and Hadamard states for Dirac fields with MIT boundary conditions*,  
 (with N. Ginoux and S. Murro), arXiv:2109.01375 [math-ph].
2. *Classical KMS Functionals and Phase Transitions in Poisson Geometry*,  
 (with S. Waldmann), arXiv:2107.04399 [math-ph].
3. *The Cauchy problem of the Lorentzian Dirac operator with APS boundary conditions*,  
 (with N. Große, S. Murro), arXiv:2104.00585 [math.AP].

## Published papers

1. *A Microlocal Approach to Renormalization in Stochastic PDEs*,  
 (with C. Dappiaggi, P. Rinaldi, L. Zambotti), Communications in Contemporary Mathematics (on line first).
2. *An operational construction of the sum of two non-commuting observables in quantum theory and related constructions*,  
 (with S. Mazzucchi and V. Moretti), Lett Math Phys 110, 3197-3242 (2020).
3. *Global wave parametrices on globally hyperbolic spacetimes*,  
 (with M. Capoferri and C. Dappiaggi), J. Math. Anal. Appl. 490 (2020) 124316.
4. *On Maxwell's Equations on Globally Hyperbolic Spacetimes with Timelike Boundary*,  
 (with C. Dappiaggi and R. Longhi), Ann. Henri Poincaré 21, 2367-2409 (2020).
5. *The notion of observable and the moment problem for \*-algebras and their GNS representations*,  
 (with V. Moretti), Lett Math Phys 110, 1711-1758 (2020).
6. *The algebra of Wick polynomials of a scalar field on a Riemannian manifold*,  
 (with C. Dappiaggi, P. Rinaldi), Reviews in Math Phys, Vol. 32, No. 08, 2050023 (2020).
7. *Equilibrium states in Thermal Field Theory and in Algebraic Quantum Field Theory*,  
 (with J. Braga de Góes Vasconcellos and N. Pinamonti), Ann. Henri Poincaré 21, 1-43 (2020).
8. *Ricci Flow from the Renormalization of Nonlinear Sigma Models in the Framework of Euclidean Algebraic Quantum Field Theory*,  
 (with M. Carfora, C. Dappiaggi, P. Rinaldi), Commun. Math. Phys. 374, 241-276 (2020).
9. *Fundamental solutions for the wave operator on static Lorentzian manifolds with timelike boundary*,  
 (with C. Dappiaggi and H. Ferreira), Lett Math Phys (2019) 109: 2157.
10. *Thermal state with quadratic interaction*,  
 Ann. Henri Poincaré (2019) 20: 905.

11. *Relative entropy and entropy production for equilibrium states in pAQFT*,  
(with F. Faldino and N. Pinamonti), Ann. Henri Poincaré (2018) 19: 3289.
12. *On the stability of KMS states in perturbative algebraic quantum field theories*,  
(with F. Faldino and N. Pinamonti), Commun. Math. Phys. (2018) 357: 267.
13. *A new class of Fermionic Projectors: Møller operators and mass oscillation properties*,  
(with S. Murro), Lett Math Phys (2017) 107: 2433.
14. *On the adiabatic limit of Hadamard states*,  
(with C. Gérard), Lett Math Phys (2017) 107: 1409.
15. *The generalized principle of Perturbative Agreement and the thermal mass*,  
(with T-P. Hack and N. Pinamonti), Ann. Henri Poincaré (2017) 18: 807.
16. *Constructing Hadamard States via an Extended Møller Operator*,  
(with C. Dappiaggi), Lett Math Phys (2016) 106: 1587.
17. *Influence of quantum matter fluctuations on geodesic deviation*,  
(with N. Pinamonti), J. Phys. A: Math. Theor. 47 (2014) 375202.

## Invited talks

- 2020 *On Maxwell's equations on globally hyperbolic spacetimes with timelike boundary*,  
invited talk within "Scattering, microlocal analysis and renormalisation" online conference,  
Institut Mittag-Leffler, 2020.06.15.
- 2019 *On Maxwell's equations on globally hyperbolic spacetimes with timelike boundary*,  
invited talk within "Operator Algebras in Quantum Field Theory and Quantum Probability" workshop,  
Department of Mathematics Roma Tor Vergata, Rome (Italy), 2019.12.04.
- \* *Ricci flow and algebraic quantum field theory*,  
Kolloquium talk at the Department of Mathematics,  
Erlangen (Germany), 2019.11.19.
- \* *Ricci flow and algebraic quantum field theory*,  
invited talk within "Algebraic and Geometric Aspects in Quantum Field Theory" workshop,  
Freiburg (Germany), 2019.04.16-18.
- 2018 *Propagators for the wave operator on Lorentzian manifold with timelike boundary*,  
invited talk within "Assemblea Nazionale del GNFM 2018",  
Montecatini (Italy), 2018.10.04-06.
- \* *Propagators for the wave operator on Lorentzian manifold with timelike boundary*,  
invited talk within "Seminari di Fisica Matematica", Department of Mathematics Federico Enriques,  
Milano (Italy), 2018.05.07.
- 2017 *Introduction to the Algebraic approach to Quantum Field Theory on curved backgrounds*,  
Lectures at Julius Maximilian University of Würzburg,  
Würzburg (Germany), 2017.10.9-13;

- \* *A mathematical approach to renormalization*,  
invited talk within “QFT Day in Milan: mathematical aspects of renormalization”,  
Department of Mathematics Federigo Enriques, Milan (Italy), 2017.04.23;
- \* *Perturbative methods in Algebraic QFT with applications to Thermal Field Theory*,  
invited talk within “Séminaire de physique mathématique à Institut Camille Jordan”, UMR 5208,  
Lyon (France), 2017.04.07;
- 2016 *Aspects of Algebraic Quantum Field Theory on Curved Spacetime*,  
invited talk within “Séminaire GDT: Problèmes Spectraux en Physique Mathématique à l’IHP”,  
Paris (France), 2016.03.01;
- 2015 *The generalized principle of Perturbative Agreement and the thermal mass*,  
invited talk at the Department of Physics of University of Pavia,  
Pavia (Italy), 2015.02.25-26;

## Contributed talks

- 2021 *Ricci flow and algebraic quantum field theory*,  
webinar within “International Congress in Mathematical Physics” conference,  
Geneve (Switzerland), 2021.08.03.
- \* *KMS functionals and b-Poisson manifolds - A guided tour through examples*,  
webinar at Institut für Mathematik, University of Würzburg (Germany), 2021.06.18.
- 2020 *Ricci flow and algebraic quantum field theory*,  
webinar at Institut für Mathematik, University of Würzburg (Germany), 2020.05.15.
- \* *Steinmann scaling degree and the extension of distributions*,  
Institut für Mathematik, University of Würzburg (Germany), 2020.02.14.
- 2019 *A friendly chat on KMS state*,  
Institut für Mathematik, University of Würzburg (Germany), 2019.11.15.
- \* *The algebra of classical observables for Maxwell  $k$ -forms on a manifold with time-like boundary*,  
Department of Mathematics, University of Trento (Italy), 2019.06.14.
- 2018 *Propagators for the wave operator on Lorentzian manifold with timelike boundary*,  
talk within “Analysis of Differential Operators on Manifolds” conference,  
Freiburg (Germany), 2018.09.24-26.
- \* *Propagators for the wave operator on Lorentzian manifold with timelike boundary*,  
talk within “Young Research Symposium” conference,  
Montreal (Canada), 2018.07.20-21.
- \* *Propagators for the wave operator on Lorentzian manifold with timelike boundary*,  
talk within “Algebraic Quantum Field Theory: Where Operator Algebra meets Microlocal Analysis” conference,  
Cortona (Italy), 2018.06.04-08.
- \* *Thermal state with quadratic interaction*,  
talk within 41th LQP Workshop “Foundations and Constructive Aspects of QFT”,  
Göttingen (Germany), 2018.02.02-03;

- 2017 *On the adiabatic limit of Hadamard states*,  
talk within 39th LQP Workshop “Foundations and Constructive Aspects of QFT”,  
Münster (Germany), 2017.01.20-21;
- 2016 *The algebraic approach to Quantum Field Theory*,  
talk within PhD Seminar at the Department of Mathematics,  
Genoa (Italy), 2016.12.15;
- 2015 *The generalized principle of Perturbative Agreement and the thermal mass*,  
talk within 36th LQP Workshop “Foundations and Constructive Aspects of QFT”,  
Leipzig (Germany), 2015.05.29-30;
- \* *The generalized principle of Perturbative Agreement and the thermal mass*,  
talk within “New Trends in Algebraic Quantum Field Theory” workshop,  
Frascati (Italy), 2015.02.11-13;
- 2014 *Influence of quantum matter fluctuations on geodesics deviation*,  
talk within 34th LQP Workshop “Foundations and Constructive Aspects of QFT”,  
Erlangen (Germany), 2014.04.25-26;

## Teaching experience

- 2021 Assistant lecturer in “Meccanica Analitica” Bachelor course.  
Department of Physics, 2021 (Trento, Italy).
- \* Lecturer in “Statistica, Algoritmi e Programmazione” Bachelor course.  
Department of Engineering (DICAM), 2021 (Trento, Italy).
- 2017 Deepening seminar within the course “Mathematical methods for physicists”.  
Department of Physics, 2017 (Pavia, Italy).
- 2015 Freshmen tutor at the Università di Genova,  
Department of Mathematics, 2016.03-2016.06 (Genoa, Italy).
- 2014 Freshmen tutor at the Università di Genova,  
Department of Mathematics, 2014.09 - 2015.07 (Genoa, Italy).
- \* Freshmen tutor at the Università di Genova,  
Department of Engineer, 2014.09 - 2015.07 (Genoa, Italy).
- 2012 Freshmen tutor at the Università di Genova,  
Department of Mathematics, 2012.06-12 (Genoa, Italy).

## Referee's activity

Referee for *Annales Henri Poincaré*, *Advances in Mathematical Physics*, *Contemporary Mathematics*, *Foundations of Physics General Relativity and Gravitation*, *Journal of Physics A: Mathematical and Theoretical*, *Journal of Mathematical Physics*, *Integral Equations and Operator Theory*, *International Journal of Geometric Methods in Modern Physics*, *Mathematical Physics*, *Analysis and Geometry*.

## Conference and workshop organization

2017 Organizer of the *Microlocal Analysis: a tool to explore the Quantum World* Workshop,  
Department of Mathematics of the Università di Genova, 2017.01.12-13;

## Co-advisor of the Master Thesis of the following students

- 2021 MSc in Physics of D. Salvi,  
Thesis title: *Algebraic approach to Non-Linear Sigma Models at second order in perturbation theory.*  
Discussed in Pavia, Italy (2021.12.17).
- 2019 MSc in Physics of R. Longhi,  
Thesis title: *On the role of boundary conditions in the construction of fundamental solutions for Maxwell's equations on spacetimes with timelike boundary.*  
Discussed in Pavia, Italy (2019.09.24).  
Awarded the Grazioli Prize, Istituto Lombardo Accademia di Scienze e Lettere.  
Awarded the Berzolari Prize, Università di Pavia.
- 2018 MSc in Physics of P. Rinaldi,  
Thesis title: *Ricci Flow from Euclidean Renormalization Group Techniques.*  
Discussed in Pavia, Italy (2018.09.27).  
Awarded the Grazioli Prize, Istituto Lombardo Accademia di Scienze e Lettere.  
Awarded the Berzolari Prize, Università di Pavia.

## Co-advisor of the Bachelor Thesis of the following students

- 2019 IUSS Diploma of P. Rinaldi,  
Thesis title: *Diffusive processes from an algebraic quantum field theory viewpoint.*  
Discussed in Pavia, Italy (2019.05.07).
- 2018 BSc in Physics of G. Musante,  
Thesis title: *Un approccio algebrico alla condensazione di Bose-Einstein.*  
Discussed in Pavia, Italy (2018.09.27).
- \* BSc in Physics of E. Mauri,  
Thesis title: *Introduction to Quantum Backflow.*  
Discussed in Pavia, Italy (2018.07.19).
- 2017 BSc in Physics of A. Marveggio,  
Thesis title: *Wave Propagation for Systems of Conservation Laws and its Applications to Fluid Dynamics.*  
Discussed in Pavia, Italy (2017.09.28).
- \* BSc in Physics of R. Longhi,  
Thesis title: *On the Fundamental Solutions for Wave-like Equations on Curved Backgrounds.*  
Discussed in Pavia, Italy (2017.07.20).

## Outreach

2017 Stage within the open day for high school

Department of Mathematics of the Università di Genova (2017.02.03);

2015 Stage within the open day for high school,

Department of Mathematics of the Università di Genova (2015.02.04-05);

## Foreign language skills

Language	Understanding		Speaking		Writing
	Listening	Reading	Spoken interaction	Spoken production	
Italian	Mother tongue				
English	C1	C1	B2	B2	C1
French	B2	B1	B2	B2	B1