

## Romeo Brunetti

---

### CONTACT INFORMATION

Dipartimento di Matematica  
Università di Trento  
Via Sommarive 14  
I-38123 Povo (TN)  
Italia

*Mobile:* +39 3406636783  
*Office:* +39 0461281562  
*Fax:* +39 0461281624  
*E-mail:* romeo.brunetti@unitn.it

### ACADEMIC APPOINTMENTS

- Associate Professor (tenure) of Mathematical Analysis** September 2010 to present  
Dipartimento di Matematica, Università di Trento
- Affiliations:
    - Mathematical Physics Group
    - INFN, Istituto Nazionale di Fisica Nucleare, sez. Trento
- Kähler Research Fellow** 2 months 2013  
ZMP, Zenter für Mathematische Physik, Hamburg, Germany,
- Senior Research Fellow** March 2007 to May 2007  
ESI, Erwin Schrödinger Institut, Vienna, Austria,
- Research Fellow under “Rientro dei Cervelli” procedure** Sept. 2006 to Aug. 2010  
Dipartimento di Matematica, Università di Trento
- Affiliations:
    - Mathematical Physics Group
    - INFN, Istituto Nazionale di Fisica Nucleare, sez. Trento
- Max-Planck Research Fellow** July to August 2006  
Max-Planck-Inst. f. Mathematik in der Naturwissenschaften, Leipzig, Germany,
- DFG Research Fellow** July 2002 to February 2003, June 2003 to February 2004, July 2004 to July 2006  
II Inst. f. Theor. Physik, Universität Hamburg, Hamburg, Germany
- Professor of Mathematical Analysis (Contract)** March to June 2002, March to June 2003, March to June 2004  
Dipartimento di Matematica, Università della Basilicata, Potenza, Italia
- Research Fellow (Assegno di Ricerca)** January 2000 to February 2002  
Dipartimento di Fisica, Università di Napoli “Federico II,” Napoli, Italia
- Marie Curie Research Fellow** March 1996 to March 1997  
II Inst. f. Theor. Physik, Universität Hamburg, Hamburg, Germany
- Post Doc** January 1995 to January 1996  
Dipartimento di Fisica, Università di Napoli “Federico II,” Napoli, Italia
- Foundation “A. Della Riccia” Research Fellow** September 1993 to February 1994  
Department of Physics, Syracuse University, Syracuse, NY, USA
- Foundation “A. Della Riccia” Research Fellow** January 1989 to June 1989  
Department de Physique, ENS, École Normale Supérieure, Paris, France

SCIENTIFIC  
ACHIEVEMENTS

- ◇ **Reconstruction of space-time symmetries from intrinsic data** (Tomita-Takesaki modular theory of standard von Neumann algebras, conformal field theories in dimensions  $d \geq 1$ : in collaboration with Guido and Longo, [17,18]).
- ◇ **First construction of Wick polynomials on Lorentzian space-times, microlocal spectrum condition** (Microlocal analysis for systems with infinite degrees of freedom: in collaboration with Köhler and Fredenhagen, [16]).
- ◇ **Complete classification of renormalization for perturbative quantum field theories on external backgrounds** (Microlocal Analysis on globally hyperbolic space-times: in collaboration with Fredenhagen, [15]).
- ◇ **Foundations of locally covariant quantum field theory** (Functorial description of physical theories,  $C^*$ -algebras: in collaboration with Fredenhagen and Verch, [11]).
- ◇ **Intrinsic Wigner formalism and Borchers commutation rules** (Modular theory of standard real subspaces, spectral condition and localizations: in collaboration with Guido and Longo, [13]).
- ◇ **First general construction of time operators in quantum mechanics (absolutely continuous Hamiltonians), and their intrinsic Heisenberg uncertainties** (Positive operator-valued measures, weights on  $C^*$ -algebras, completely positive maps: in collaboration with Fredenhagen, [5,12,14]).
- ◇ **Superselection sectors for locally covariant quantum field theory, and new sectors of topological nature** (Analysis of theories with infinite degrees of freedom described by  $C^*$ -algebras on globally hyperbolic spacetimes, geometric invariants: in collaboration with Ruzzi, [7,9]).
- ◇ **Construction of relativistic interacting classical field theories** (Infinite dimensional geometry, quasi-linear hyperbolic equations on globally hyperbolic spacetimes, Nash-Moser Theorem: in collaboration with Fredenhagen and Ribeiro, [24,26,27]).
- ◇ **Perturbative Quantum Gravity as a locally covariant quantum field theory** (Batalin-Vilkoviski formalism with infinite dimensional geometry, construction of states for interacting theory, background independence: in collaboration with Fredenhagen and Rejzner, [3]).
- ◇ **Cosmology and Quantum Gravity** (Derivation of Standard Cosmological Perturbation Theory from first principles of Quantum Gravity, in collaboration with Fredenhagen, Hack, Pinamonti and Rejzner, [2]).

METRICS

★ citations= 1996, h-index=20, i10-index=24 (source Google Scholar: [GoogleScholar](#))

BOOKS

- [1] *Advances in Algebraic Quantum Field Theory*. R. Brunetti, C. Dappiaggi, K. Fredenhagen, J. Yngvason Ed.. Springer Verlag, Berlin, October 2015.

REFEREED  
JOURNAL  
PUBLICATIONS

- [2] R. Brunetti, K. Fredenhagen, T-P Hack, N. Pinamonti, and K. Rejzner, *Cosmological Perturbation Theory and Quantum Gravity*, *J. High Energ. Phys.* (2016) 2016: 32. doi:10.1007/JHEP08(2016)032
- [3] R. Brunetti, K. Fredenhagen, and K. Rejzner, *Quantum Gravity as a Locally Covariant Quantum Field Theory*. *Communications in Mathematical Physics*. Online First (2016), doi:10.1007/s00220-016-2676-x

- [4] R. Brunetti, K. Fredenhagen, P. Imani and K. Rejzner, The Locality Axiom in Quantum Field Theory and Tensor Products of  $C^*$ -algebras. *Reviews in Mathematical Physics*, 26(6):1450010 (2014) doi:10.1142/S0129055X1450010X
- [5] R. Brunetti, K. Fredenhagen and M. Hoge, Time in quantum physics: from an external parameter to an intrinsic observable. *Foundations of Physics*, 40(9-10):1368-1378, (2010). doi:10.1007/s10701-009-9400-z
- [6] R. Brunetti, M. Dütsch and K. Fredenhagen, Algebraic quantum field theory and the renormalization groups, *Advances in Theoretical and Mathematical Physics*, 13(5):1541-1599, (2009).
- [7] R. Brunetti and G. Ruzzi, Quantum charges and spacetime topology: The emergence of new superselection sectors, *Commun. Math. Phys.* 287, 523-563 (2009).
- [8] R. Brunetti, L. Franceschini and V. Moretti, Topological sectors for massive bosons on two dimensional Einstein cylinder. I: Spatial Approach, *Ann. Inst. H. Poincaré*, (2009).
- [9] R. Brunetti and G. Ruzzi, Superselection sectors and general covariance. I, *Commun. Math. Phys.* 270, 69-108 (2007).
- [10] R. Brunetti, K. Fredenhagen and S. Hollands, A remark on alpha vacua for quantum field theory on de Sitter space, *JHEP* 05 (2005) 063-067.
- [11] R. Brunetti, K. Fredenhagen and R. Verch, The generally covariant locality principle – a new paradigm in local quantum field theory, *Commun. Math. Phys.*, 237, (2003) 221-241.
- [12] R. Brunetti and K. Fredenhagen, Remarks on time-energy uncertainty relations, *Rev. Math. Phys.*, 14, (2002) 897-903.
- [13] R. Brunetti, D. Guido and R. Longo, Modular localization and Wigner particles, *Rev. Math. Phys.*, 14, (2002) 759-785.
- [14] R. Brunetti and K. Fredenhagen, Time of occurrence observable in quantum mechanics, *Phys. Rev. A* 66 (2002) 044101-044105.
- [15] R. Brunetti and K. Fredenhagen, Microlocal analysis and interacting quantum field theories; Renormalization on physical backgrounds, *Commun. Math. Phys.* 208, (2000) 623-661. (**Featured Review on Mathematical Reviews**, MR1736329 (2001 g:81176))
- [16] R. Brunetti, K. Fredenhagen and M. Köhler, The microlocal spectrum condition and the Wick polynomials of free fields on curved spacetimes, *Commun. Math. Phys.* 180, (1996) 633-652.
- [17] R. Brunetti, D. Guido and R. Longo, Group cohomology, modular theory and space-time symmetries, *Reviews in Math. Phys.* 7, (1995) 54-71.
- [18] R. Brunetti, D. Guido and R. Longo, Modular structure and duality for conformally invariant theories, *Commun. Math. Phys.*, 156, (1993) 201-219.
- [19] R. Brunetti, G. Parisi and F. Ritort, Asymmetric Little spin glass model, *Phys. Rev. B*, 46 (1992) 5339-5355.
- [20] R. Brunetti, G. Parisi and F. Ritort, Study of the asymmetric Little model, *Physica A*, 185 (1992) 247-253.
- [21] R. Brunetti, G. Parisi and F. Ritort, On the replica symmetry for random weighted matchings, *J. Phys. A: Math. Gen.* 24, (1991) 5077-5083.

- [22] R. Brunetti, W. Krauth, M. Mézard and G. Parisi, Extensive numerical simulation of weighted matchings: total length and distribution of links in the optimal solution, *Europhysics Letters*, 14 (4), (1991) 295-301.
- [23] R. Brunetti and G. Parisi, Cavity fields approach in spin glasses; one step beyond, *Europhysics Letters*, 11 (3), (1990) 281-286.
- SUBMITTED  
JOURNAL  
PUBLICATIONS
- [24] R. Brunetti, K. Fredenhagen and P.L. Ribeiro, Algebraic Structure of Classical Field Theory: Kinematics and Linearized Dynamics for Real Scalar Fields. Submitted to *Communications in Mathematical Physics* (2017). [arXiv:1209.2148](https://arxiv.org/abs/1209.2148)
- [25] C. Bergbauer, R. Brunetti and D. Kreimer, Renormalization and resolution of singularities. Submitted to *Communications in Mathematical Physics* (2010). [arXiv:0908.0633](https://arxiv.org/abs/0908.0633)
- PAPERS IN  
PREPARATION
- [26] R. Brunetti, K. Fredenhagen and P. L. Ribeiro, Algebraic Structure of Classical Field Theory II: The Main Dynamical Theorem and its Applications. (manuscript 2013)
- [27] R. Brunetti, K. Fredenhagen and P. L. Ribeiro, Algebraic Structure of Classical Field Theory III: The Principle of Space-Time Descent. (manuscript 2013)
- [28] R. Brunetti, K. Fredenhagen, T-P. Hack, N. Pinamonti and K. Rejzner, Quantum Effects in Standard Cosmology, (2016)
- [29] R. Brunetti. K. Fredenhagen, Quantum Field Theory of interacting Bose-Einstein condensate in a trap, (2016)
- WORKS IN  
PROGRESS
- [30] R. Brunetti and P. L. Ribeiro, Towards Fedosov construction in Perturbative Algebraic Quantum Field Theory. (manuscript 2014)
- CHAPTERS IN  
BOOKS
- [31] R. Brunetti and K. Fredenhagen, Quantum Field Theories on Curved Backgrounds, chapter 5 in: *Lectures Notes in Physics*, vol.786, Springer 2009.
- [32] R. Brunetti and V. Moretti, Quantum field theories on curved spacetimes, *Encyclopedia of Mathematical Physics*, Springer-Verlag (2007).
- [33] R. Brunetti, M. Poppmann and G. Ruzzi, General covariance in algebraic quantum field theory, in "Lecture Notes of Seminario Interdisciplinare di Matematica", vol.5 (2006), ed. E. Barletta.
- [34] R. Brunetti and K. Fredenhagen, Algebraic approach to quantum field theory. *Encyclopedia of Mathematical Physics*, Elsevier Publishing (2004).
- REFEREED  
CONFERENCE  
PUBLICATIONS
- [35] R. Brunetti and K. Fredenhagen, Towards a background independent formulation of perturbative quantum gravity, in: *Quantum Gravity –Mathematical Models and Experimental Bounds*, B. Fauser, J. Tolksdorf, E. Zeidler Eds., Birkhäuser Basel, 2006, 151-159.
- [36] R. Brunetti, Locally covariant quantum field theories, in: *Rigorous Quantum Field Theory, A Festschrift for Jacques Bros*, Progress in Mathematics vol. 251, A. Boutet de Monvel, D. Buchholz, D. Iagolnitzer, U. Moschella Eds., Birkhäuser Basel, 2006, 39-47.
- [37] R. Brunetti and K. Fredenhagen, Interacting quantum fields on curved background, XII International Congress in Mathematical Physics, Brisbane, Australia 1997, International Press 1999.
- [38] R. Brunetti and K. Fredenhagen, Interacting quantum fields in curved space: Renormalization of  $\phi^4$ , "Operator Algebras and Quantum Field Theory," ed. S. Doplicher, R. Longo, J.E. Roberts, L. Szido, International Press 1997.

- CONFERENCE TALKS [39] R. Brunetti and P. L. Ribeiro, A Semiclassical Interacting \*-Product in Perturbative Algebraic Quantum Field Theory. Presentation at the Conference “Mathematical Aspects of Quantum Field Theory and Quantum Statistical Mechanics” (Hamburg, July 30th – August 1st, 2012). Available at <http://www.qq12.org/talks/Monday/8.Ribeiro.pdf>.
- CONFERENCE POSTERS [40] R. Brunetti, K. Fredenhagen and P. L. Ribeiro, The Principle of Space-Time Descent. XVII International Congress on Mathematical Physics (Aalborg, August 6 – 11, 2012). Available at <http://docs.math.aau.dk/timeline/e-posters/S09/Ribeiro.pdf>. Prize for the best poster of the Congress.
- OTHER PUBLICATIONS [41] R. Brunetti, Perturbative quantum field theories: Still surprises?, ESI-News, December 2007.
- [42] R. Brunetti, Simmetrie e Dualità in Teoria Algebrica dei Campi. Ph.D. thesis (1994) (in Italian)
- [43] R. Brunetti, Fluttuazioni e stabilità nei vetri di spin. Diploma thesis (1988) (in Italian)
- UNPUBLISHED MANUSCRIPTS [44] R. Brunetti, K. Fredenhagen and K. Szlachany, On the construction of the universal algebra for (even) CAR algebras on the circle. (1994).
- [45] R. Brunetti and K. Fredenhagen, Natural domains for Wick Polynomials of a Free Massive Scalar Field. (2000).
- [46] R. Brunetti, On revival times via time of occurrence observables. (2004).
- [47] R. Brunetti and K. Fredenhagen, Regularized alpha vacua and inflation. (2007).
- [48] R. Brunetti and V. Moretti, On Modular dynamics. (2010)
- GRANTS, FELLOWSHIPS, HONORS, PRIZES
- ◇ *Habilitation for professorship in Italy for Mathematical Physics* 2013.
  - ◇ *ZMP Kähler Fellowship* 2013 (ZMP, Hamburg University)
  - ◇ *Prize for Best-Poster at International Congress in Mathematical Physics*, Prague (CZ) 2009.
  - ◇ *Habilitation for professorship in France by the CNU (Conseil National des Universités)* 2007.
  - ◇ *Erwin Schrödinger Institute Senior Fellowship* 3/2007 – 4/2007.
  - ◇ *Max Planck Institute fellowship* 2006 (MPI, Leipzig, Germany)
  - ◇ *Winner of the competitive procedure "Rientro dei cervelli" (Revert of Brain Drain) of the Italian Ministry of University and Research (MIUR)* 2006.
  - ◇ *Deutsche Forschungsgemeinschaft, DFG, fellowship* 2002 – 2006. (Hamburg Universität, Hamburg, Germany)
  - ◇ *Featured Review in Mathematical Reviews* MR1736329 (2001 g:81176).
  - ◇ *Marie Curie research fellowship* 1996 – 1997. (Hamburg Universität, Hamburg, Germany)
  - ◇ *Foundation “Angelo Della Riccia” research fellowship* 1993. (Syracuse University, Syracuse, N.Y., U.S.A.)
  - ◇ *Foundation “Angelo Della Riccia” research fellowship* 1989. (École Normale Supérieure, Paris, France)

ACADEMIC  
SERVICE

**Doctorate's Board**

Università di Trento, Dipartimento di Matematica, 2007 – to present.

**National Evaluation of Research**

Referee, 2008.

STUDENT  
ADVISING

**Master**

• **Lorenzo Franceschini**

Master level student, Dipartimento di Fisica, Università di Trento.  
Superselection sectors of topological origin. 2008-2009.

• **Chiara Entradi**

Master level student, Dipartimento di Fisica, Università di Milano.  
Renormalization on Riemannian spaces. 2012-2013.

**Post-doc**

• **Igor Khavkine**

Post-doc, Dipartimento di Matematica, Università di Trento.  
Quantum Gravity. 2013-2015.

PROFESSIONAL  
SERVICE

**Editorial Boards**

- *Abstract and Applied Analysis*, Hindawi Publishing Corporation. (IF 1.102, ISI 2012)
- *Mathematical Analysis*, The Scientific World Journal, Hindawi Publishing Corporation. (IF 1.730, ISI 2012)

**Referee Service (Main Journals)**

- *Communications in Mathematical Physics*
- *Reviews in Mathematical Physics*
- *Annales de l'Inst. H. Poincaré*
- *Journal of Mathematical Physics*
- *Journal of Non Commutative Geometry*

**Conference Service**

- Mini-Workshop at Mathematical Institute of Oberwolfach, Oberwolfach, Germany, October 2000, "Quantum Field Theory and Microlocal Analysis," in collaboration with K. Fredenhagen and E. Schrohe.
- Research Program at E.S.I. on "Mathematical and Physical Aspects of Perturbative Approaches to Quantum Field Theory," Wien, Austria, March-April 2007, in collaboration with K. Fredenhagen, D. Kreimer, and J. Yngvason.
- Workshop at E.S.I. "New Developments for Perturbative Quantum Field Theories," Wien, Austria 26.3.2007-30.3.2007, in collaboration with K. Fredenhagen, D. Kreimer, and J. Yngvason.
- Mini-workshop Mathematical Institute of Oberwolfach, Oberwolfach, Germany, October 2013, "New Crossroads between Mathematics and Field Theory," 21 July - 27 July 2013 in collaboration with C. Bär, C. Dappiaggi, and K. Fredenhagen.
- Workshop at E.S.I. "Algebraic Quantum Field Theory: Its status and its future," Wien, Austria 26.5.2014-30.5.2014, in collaboration with C. Dappiaggi, K. Fredenhagen, and J. Yngvason.

TEACHING  
ACTIVITY

- “Algebraic aspect of local quantum theories,” Dip. Scienze Fisiche, Univ. di Napoli “Federico II,” 1991
- “Mathematical Methods in Physics,” Dip. Scienze Fisiche, Univ. di Napoli “Federico II,” 1999-2000
- “Mathematical Methods in Physics,” Dip. Scienze Fisiche, Univ. di Napoli “Federico II,” 2000-2001
- “Mathematical Methods in Physics,” Dip. Scienze Fisiche, Univ. di Napoli “Federico II,” 2001-2002
- “Mathematical Analysis II” for mathematicians, Dip. di Matematica, Univ. della Basilicata, 2001-2002
- “Mathematical Analysis IV” for mathematicians, Dip. di Matematica, Univ. della Basilicata, 2001-2002
- “Introduction to microlocal analysis and applications to quantum field theory,” Dept. of Mathematics, Hamburg Univ., 2001
- “Mathematical Analysis II ” for mathematicians, Dip. di Matematica, Univ. della Basilicata, 2002-2003
- “Mathematical Analysis IV” for mathematicians, Dip. di Matematica, Univ. della Basilicata, 2002-2003
- “Mathematical Analysis II” for mathematicians, Dip. di Matematica, Univ. della Basilicata, 2003-2004
- “Mathematical Analysis IV” for mathematicians, Dip. di Matematica, Univ. della Basilicata, 2003-2004
- “Microlocal Analysis,” Dip. di Matematica, Univ. di Trento, 2007-2008
- “Mathematical Aspects in Quantum Mechanics,” Dip. di Matematica, Univ. di Trento, 2008-2009
- “Analysis II,” Faculty of Engineering, Univ. di Trento, 2008-2009
- “Analysis II,” Faculty of Engineering, Univ. di Trento, 2009-2010
- “Analysis II,” Faculty of Engineering, Univ. di Trento, 2010-2011
- “Analysis I,” Faculty of Engineering, Univ. di Trento, 2010-2011
- “Analysis I,” Faculty of Engineering, Univ. di Trento, 2011-2012
- “Mathematics and Statistics,” Faculty of Engineering, Univ. di Trento, 2011-2012
- “Analysis I,” Faculty of Engineering, Univ. di Trento, 2012-2013
- “Geometry and Linear Algebra,” Faculty of Engineering, Univ. di Trento, 2012-2013
- “Analysis 2,” Dept. of Information and Communications Technologies, Univ. di Trento, 2013-2014
- “Analysis II,” Dept. of Physics Univ. di Trento, 2013-2014
- “Analysis II,” Dept. of Physics, Univ. di Trento, 2014-2015
- “Analysis III,” Dept. of Physics, Univ. di Trento, 2015-2016
- PAF (Percorso di Approfondimento in Fisica) (honor classes: Hutchinson’s Theorem and self-similar fractals as IFS), Dept. of Physics, Univ. di Trento, 2014-2015
- “Analysis II,” Dept. of Physics, Univ. di Trento, 2015-2016
- PAF (Percorso di Approfondimento in Fisica) (honor classes: Hutchinson’s Theorem and self-similar fractals as IFS), Dept. of Physics, Univ. di Trento, 2015-2016
- “Analysis III,” Dept. of Physics, Univ. di Trento, 2016-2017
- “Topics in the Mathematical Physics of Quantum Theory,” Dept. of Mathematics/Physics, Master, Univ. di Trento, 2016-2017
- “Analysis II,” Dept. of Physics, Univ. di Trento, 2016-2017
- “Dynamical evolutions in quantum lattice theories,” Dept. of Mathematics, Ph.D., Univ. di Trento, 2016-2017