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**Paolo Giordano
CURRICULUM VITAE**

INFORMAZIONI PERSONALI (NON INSERIRE INDIRIZZO PRIVATO E TELEFONO FISSO O CELLULARE)

COGNOME	GIORDANO
NOME	PAOLO
DATA DI NASCITA	27, MARZO, 1966

**INSERIRE IL PROPRIO CURRICULUM
(non eccedente le 30 pagine)**

Data

15/09/2020

Luogo

Milano

Curriculum vitae

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Web site: www.mat.univie.ac.at/~giordap7/
Present position: Senior researcher, Wolfgang Pauli Institute, University of Vienna

Present research interests

- Nonlinear theories of generalized functions
- Non-Archimedean mathematical analysis (but **no one** of my papers is on non-standard analysis)
- Foundation of infinite-dimensional analysis and differential geometry
- Mathematical theories of complex systems
- Transportation modeling and related decision support systems
- Mathematical modeling of urban growth and housing markets

Education

- *University of Bonn*, Ph.D. in Mathematics awarded in December 2009. In the thesis we use methods of non-Archimedean analysis to study non-normable infinite dimensional spaces. Title: “Fermat reals: nilpotent infinitesimals and infinite dimensional spaces”. Supervisor Prof. S. Albeverio. Degree "Very good + (0.7)"; overall grade of the promotion "magna cum laude".
- *Università degli Studi di Milano*, M.Sc. in Mathematics. Title: “A model of extended line with actual infinitesimals”. Supervisor Prof. L. Galgani. Degree 110/110 Cum laude.
- *Habilitation* (venia docendi in Mathematics), University of Vienna, Austria, November 2019. External habilitation committee: V. Benci (University of Pisa), C. Garetto (Loughborough University), I.V. Melnikova (Ural Federal University).

Academic experiences

Main research activities as principal investigator and awards

- August 2020 - present: project leader of FWF (Austrian Fund for the Promotion of Scientific Research) stand alone research project *Functional analysis of infinite bounded operators*. Co-applicants and collaborators of the project are Prof. M. Kunzinger (Dep. of Mathematics, University of Vienna, Austria) and Prof. H. Vernaëve (Dep. of Mathematics, University of Ghent, Belgium). See [URL](#)
 - In the three years project we study unbounded linear operators as bounded operators with an infinite Lipschitz constant in the ring of Colombeau generalized numbers with gauge. The proposal aims at showing the flexibility of a non-Archimedean framework in strongly extending classical results of functional analysis using a simpler setting, and in applications to singular PDE and QM.
 - Starting from September, in this project we plan to enroll one or two PhD students at the University of Vienna.
 - The project funding is of 407'000 Euro.
- August 2017 - present: project leader of FWF (Austrian Fund for the Promotion of Scientific Research) stand alone research project *Hyperfinite methods for generalized smooth functions*, Wolfgang Pauli Institute, Vienna. Co-applicant and collaborator of the project is Prof. M. Kunzinger (Dep. of Mathematics, University of Vienna, Austria). See [URL](#)
 - The three years project concerns the study of hyperfinite methods for generalized functions, the proof of general theorems for the solutions of singular nonlinear PDE and the study of a Fourier transform that applies to every generalized function (not only to those of tempered type).
 - In this project I am the Ph.D. supervisor of A. Mukhammadiev and D. Tiwari at the University of Vienna.
 - The project funding is of 397'000 Euro.
- December 2012 - May 2016: project leader of FWF stand alone research project *Analysis and Geometry based on generalized numbers*, Dep. of Mathematics, University of Vienna. Co-applicant and collaborator of the project is Prof. M. Kunzinger (Dep. of Mathematics, University of Vienna, Austria). See [URL](#)
 - The four years project concerns the development of a new theory of generalized functions as set-theoretical maps on a non-Archimedean ring of generalized numbers. These generalized functions extend Schwartz distributions but are closed with respect to composition.
 - The project funding was of 321'000 Euro.
- June 2013 - May 2016: project leader of FWF stand alone research project *Non-Archimedean Geometry and Analysis*, Dep. of Mathematics, University of Vienna (AT). Co-applicants of the project: Prof. M. Kunzinger (Dep. of Mathematics, University of Vienna, Austria) and Prof. V. Benci (Dep. of Mathematics, University of Pisa, Italy). See [URL](#)
 - The three years project concerns the development of the theory of Fermat reals for the study of non-normable infinite dimensional spaces and its applications, as well as the relationships with other branches of Non-Archimedean analysis.
 - In this project I supervised two senior post-docs: L. Luperi Baglini (at present, he is researcher at the University of Milan) and E. Wu (at present, he is professor at Shantou University, CN).
 - The project funding was of 349'000 Euro.
- October 2010 - September 2012: project leader of the research project *Nilpotent Infinitesimals and Generalized Functions*, Dep. of Mathematics, University of Vienna, supported by an FWF Lise Meitner grant. Co-applicant of the project: Prof. M. Kunzinger (Dep. of Mathematics, University of Vienna, Austria). See [URL](#)
 - The project concerned the application of non-Archimedean analysis to generalized functions.

- The project funding was of 115'200 Euro.
- June 2006 - July 2009: director, together with A. Vancheri, of the research project *Supporto alle decisioni basato su modello matematico per il problema dei “grandi generatori di traffico”*, Dep. of Mathematics, University of Italian Switzerland. See [URL](#)
 - The project funding from Canton Ticino's administration was of 89'577 Euro.
- February 2005 - June 2009: director of the European Commission research project (Marie Curie reintegration grant MERG-CT-2005-014906) *Continuum State Cellular Automata and Random Equations*, Dep. of Mathematics, University of Italian Switzerland.
 - The project funding was of 40'000 Euro.
- March 2002 - February 2004: Marie Curie individual fellowship of the European Commission HPMF-CT-2002-01792, *A new approach to differential geometry of spaces of mappings and its applications*, Institute of Applied Mathematics, University of Bonn.
 - The project funding was of 140'200 Euro.
- June 2001 - November 2001: DAAD (Deutscher Akademischer Austausch Dienst, German academic exchange service) fellowship at the Dep. of Mathematics of the University of Bonn.

Research activities as co-director

- May 2007 - December 2009: co-director of the SNSF research project *Effects of Neighborhood Choice on Housing Markets: a model based on the interaction between microsimulations and revealed/stated preference modeling*, Dep. of Mathematics, Accademia di architettura, University of Italian Switzerland (CH). Director of the project: Prof. Dr. R. Maggi, Istituto di Ricerche Economiche, University of Italian Switzerland. See [URL](#)
 - In this context I was PhD co-advisor of M. Esmaili.
 - The project funding was of 241'650 Chf.
- September 2006 - December 2009: co-director of the Swiss National Science Foundation research project *Mathematical modeling of on-line communities*, Dep. of Mathematics, University of Italian Switzerland. Director of the project: Prof. Dr. A. Vancheri. See [URL](#)
 - In this context I was PhD co-advisor of G.L. Ciampaglia (at present, he is professor at University of South Florida).
 - The project funding was of 120'800 Chf.

Main invited lectures

1. Invited speaker at the conference “Souriau 2019”, May 27-31 2019, Paris-Diderot University; title: “The Grothendieck topos of generalized functions”.
2. Invited talk at Institute for Scientific Interchange (ISI), Turin, 30 November 2016, “MaTryCS - A mathematical theory of complex systems”.
3. Invited plenary lecture at the conference “Algebra, Geometry and Mathematical Physics”, Brno, Czech Republic, September 12-14, 2012; title: “Infinitesimal without Logic”.
4. Invited talks at the University of Pisa, January 21, 2015: title: “Generalized smooth functions”, “Fermat reals”.
5. Invited opening talk at the workshop “Workshop on diffeologies etc”, Aix en Provence, France, June 25 - 27, 2014. Title: “Theory of infinitely near points in smooth manifolds: the Fermat functor”.

6. Invited speaker at the colloquium of the Interdisziplinäre Zentrum für Komplexe Systeme (IZKS, Bonn, Germany), June 2009; title: “Dynamics of cities: A mathematical planning tool for shopping malls”.
7. Invited speaker at the conference VIIth AESOP workshop, Thematic Group on Planning and Complexity, Milan, 22 - 23 February 2008; title: “Interaction Spaces Theory: modeling complex systems with the details of MAS and the mathematics of Synergetics”.

Reviewing activities

I am reviewer for: Acta Mathematica, American Mathematical Monthly, Journal of the London Mathematical Society, Topology proceedings, Arabian Journal of Mathematics, Commentationes Mathematicae Universitatis Carolinae, Novi Sad Journal of Mathematics, Advances in Complex Systems, Environmental modelling and software, Physics Letters A.

Teaching activities

- 2018 - present: Ph.D. supervisor of 2 students at the Faculty of Mathematics, University of Vienna, AT.
- 2012 - 2015: research supervisor of 2 senior post-docs, Faculty of Mathematics, University of Vienna, AT.
- 2010 - 2014: teaching of the 1st year master course *Metodi quantitativi per l'analisi del territorio*, Accademia di architettura di Mendrisio, University of Italian Switzerland.
- 2009: co-teaching of the 1st year master course *Metodi quantitativi per l'analisi del territorio*, Accademia di architettura di Mendrisio, University of Italian Switzerland, together with A. Vancheri.
- 2006 - 2009: Ph.D. co-advisor of M. Esmaili and G.L. Ciampaglia.
- 2004 - 2005: lecturer of the courses MATLAB I and Probability I for the researchers of the SNSF research project *Mathematical modeling of urban growth processes: a cellular automata and statistical mechanical based approach*.
- 1999: lecturer of the course *Programming language MATLAB* at the Politecnico di Milano, Italy, Mechanics and Aeronautics Engineering courses.
- 1999 - 2003: teaching assistant, Dep. of Mathematics, Università della Svizzera Italiana.
- 1997 - 1999: lecturer of the 1st year course of Mathematics, Dep. of Economics of the II facoltà di Economia di Novara, Italy.

Publications

In my publications, where my name appears as the last one, I proposed and supervised the majority of ideas as well as actively contributed in developing them.

All the following publications have been peer-reviewed and listed in ISI Web of Science, Scopus or DOAJ. Non indexed publications are: [12](#), [15](#), [16](#), [25](#). Please note that **no one** of my articles is about non-standard analysis.

For the links to these publications, see my home page: www.mat.univie.ac.at/~giordap7/

1. Giordano P., Kunzinger M., A convenient notion of compact set for generalized functions. Proceedings of the Edinburgh Mathematical Society, Volume 61, Issue 1 February 2018 , pp. 57-92, 2018. DOI: <https://doi.org/10.1017/S0013091516000559>
2. Lecke A., Luperi Baglini L., Giordano P., The classical theory of calculus of variations for generalized functions. Advances in Nonlinear Analysis, Vol. 8, Issue 1, 2017. DOI: <https://doi.org/10.1515/anona-2017-0150>.
3. Luperi Baglini L., Giordano P., The category of Colombeau algebras. Monatshefte für Mathematik, 2017, Volume 182, Issue 3, pp. 649–674, 2017. DOI <https://doi.org/10.1007/s00605-016-0990-1>.

4. Giordano P., Kunzinger M., Inverse Function Theorems for Generalized Smooth Functions. In: Oberguggenberger M., Toft J., Vindas J., Wahlberg P. (eds) Generalized Functions and Fourier Analysis. Operator Theory: Advances and Applications, vol 260. Birkhäuser, Cham, 2017. DOI: https://doi.org/10.1007/978-3-319-51911-1_7
5. Giordano P., Wu E., Calculus in the ring of Fermat reals. Part I: Integral calculus. *Advances in Mathematics*, Vol. 289, pp. 888–927, 2016. DOI: <https://doi.org/10.1016/j.aim.2015.11.021>
6. Giordano P., Luperi Baglini L., Asymptotic gauges: Generalization of Colombeau type algebras. *Math. Nachr.* Volume 289, Issue 2-3, pages 247–274, 2016. DOI: <https://doi.org/10.1002/mana.201400278>
7. Giordano P., Nigsch E., Unifying order structures for Colombeau algebras. *Math. Nachr.* 288, No. 11–12, 1286–1302, 2015. DOI: <https://doi.org/10.1002/mana.201400277>
8. Giordano P., Wu E., Categorical framework for generalized functions. *Arabian Journal of Mathematics*, Volume 4, Issue 4, pp 301–328, 2015. DOI: <https://doi.org/10.1007/s40065-015-0126-9>
9. Giordano P., Kunzinger M., Vernaev H., Strongly internal sets and generalized smooth functions. *Journal of Mathematical Analysis and Applications*, volume 422, issue 1, 2015, pp. 56–71. DOI: <https://doi.org/10.1016/j.jmaa.2014.08.036>
10. Vancheri A., Giordano P., Andrey D., Fuzzy logic based modeling of traffic flows induced by regional shopping malls. *Advances in Complex Systems* Vol. 17, N. 3 & 4, 2014, (39 pages). DOI: <https://doi.org/10.1142/S0219525914500179>
11. Giordano P., Caputo P., Vancheri A., Fuzzy evaluation of heterogeneous quantities: measuring urban ecological efficiency. *Ecological Modelling* 288, 2014, pp. 112–126. DOI: <https://doi.org/10.1016/j.ecolmodel.2014.06.001>
12. Giordano P., Which numbers simplify your problem?. Invited contribution for the volume: Mathematics without boundaries: surveys in pure mathematics. T. Rassias and P. Pardalos (Eds.), Springer 2014, XIII, pp. 181–220. See www.springer.com/mathematics/analysis/book/978-1-4939-1105-9
13. Giordano P., Fermat reals: infinitesimals without Logic. *Miskolc Mathematical Notes*, Vol. 14 (2013), No. 2, pp. 407–422. DOI: <https://doi.org/10.18514/MMN.2013.902>
14. Giordano P., Kunzinger M., New topologies on Colombeau generalized numbers and the Fermat-Reyes theorem. *Journal of Mathematical Analysis and Applications*, Vol. 399, Issue 1, pp. 229–238, 2013. DOI: <https://doi.org/10.1016/j.jmaa.2012.10.005>
15. Vancheri A., Giordano P., Caputo P., A 2009 European index of urban metabolism efficiency, in *A new urban metabolism*, J.A. Acebillo, A. Martinelli (eds), Actar, 2013. See searchworks.stanford.edu/view/10196912
16. Esmaeili M., Vancheri A., Giordano P., Modeling housing market dynamics using a multi-agent simulation of participants' cognitive behavior. In L. Diappi (editor) *Emergent phenomena in housing markets: gentrification, housing search, polarization*. Physica-Verlag, 2012, pp. 43–83. See www.springer.com/economics/regional+science/book/978-3-7908-2863-4
17. Giordano P., Kunzinger M., Topological and algebraic structures on the ring of Fermat reals. *Israel Journal of Mathematics*, January 2013, Volume 193, Issue 1, pp. 459–505. DOI: <https://doi.org/10.1007/s11856-012-0079-z>
18. Giordano P., Fermat-Reyes method in the ring of Fermat reals. *Advances in Mathematics* 228, pp. 862–893, 2011. DOI: <https://doi.org/10.1016/j.aim.2011.06.008>
19. Giordano P., Infinite dimensional spaces and Cartesian closedness. *Journal of Mathematical Physics, Analysis, Geometry*, vol. 7, No. 3, pp. 225–284, 2011. See www.mathnet.ru/php/archive.phtml?wshow=paper&jrnid=jmag&paperid=514&option_lang=eng

20. Giordano P., The ring of fermat reals, *Advances in Mathematics* 225 (2010), pp. 2050-2075.
DOI: <https://doi.org/10.1016/j.aim.2010.04.010>
21. Giordano P., Infinitesimals without logic, *Russian Journal of Mathematical Physics*, 17(2), pp.159-191, 2010.
DOI: <https://doi.org/10.1134/S1061920810020032>
22. Esmaceli M., Vancheri A., Giordano P., Mathematical and Computational Modeling of Housing Market Dynamics. *Systems Conference, 2010 4th Annual IEEE*, pp. 29 - 34, 2010.
DOI: <https://doi.org/10.1109/SYSTEMS.2010.5482468>
23. Vancheri A., Giordano P., Andrey D., Albeverio S., A model for urban growth processes with continuous state cellular automata, multi-agents and related differential equation. Part 1: Theory. *Environment and Planning B: Planning and Design* 2008, volume 35, issue 4, pages 723-739. DOI: <https://doi.org/10.1068/b31080a>
24. Vancheri A., Andrey D., Giordano P., Albeverio S., A model for urban growth processes with continuous state cellular automata, multi-agents and related differential equation. Part 2: Computer Simulations. *Environment and Planning B: Planning and Design* 2008, volume 35, pages 863-880. DOI: <https://doi.org/10.1068/b31080b>
25. Albeverio S., Giordano P., Minazzi F., Introduzione a Matematica e Filosofia, il problema dei fondamenti oggi. *Atti del convegno di Mendrisio, 16 novembre 2001. PRISTEM/Storia* 14-15, 2006. See matematica-old.unibocconi.it/publicazioni/notestoria14-15.htm
26. Giordano P., Infinitesimal Differential Geometry, *Acta Mathematica Universitatis Comenianae*, 2004, LXIII, 2, pp. 235-278. See www.emis.de/journals/AMUC/_vol-73/_no.2/_giordano/giordano.html
27. Giordano P., Nilpotent infinitesimals and synthetic differential geometry in classical logic. In Berger, Oswald, and Schuster, editors, "Reuniting the Antipodes - Constructive and Nonstandard Views of the Continuum". Peer reviewed conference paper: see proceedings of the Symposion in Venice, May 17-22, 1999. Vol. 306 of *Synthese Library*, Kluwer Academic Publishers, Dordrecht, 2001, pp. 75-92. DOI 10.1007/978-94-015-9757-9_7
28. Bussotti F., Ferretti M., Giordano P. and Mazzali C., A synthetic index to estimate tree condition in the Permanent Monitoring Plots of the CONECOFOR programme, *Annali dell'Istituto Sperimentale per la Selvicoltura*, volume 30, pp. 67-72, 1999.
See www.corpoforestale.it/flex/cm/pages/ServeAttachment.php/L/IT/D/D.c8dc2e20c6ec76375728/P/BLOB%3AID%3D1017
29. Ferretti M., Giordano P. and Mazzali C., Methods of analysis of the Integrated and Combined (I&C) evaluation system. *Annali dell'Istituto Sperimentale per la Selvicoltura*, volume 30, pp. 33-42, 1999.
See www.corpoforestale.it/flex/cm/pages/ServeAttachment.php/L/IT/D/D.c8dc2e20c6ec76375728/P/BLOB%3AID%3D1017
30. Ferretti M., Giordano P. and Mazzali C., Definitions of risk, status and changes in the Permanent Monitoring Plots in Italy – A preliminary attempt. *Annali dell'Istituto Sperimentale per la Selvicoltura*, volume 30, pp. 135-149, 1999.
See www.corpoforestale.it/flex/cm/pages/ServeAttachment.php/L/IT/D/D.c8dc2e20c6ec76375728/P/BLOB%3AID%3D1017
31. Ferretti M., F. Alianiello, S. Allavena, T. Amoriello, E. Amorini, F.A. Biondi, A. Buffoni, F. Bussotti, G. Campetella, R. Canullo, A. Costantini, A. Cutini, G. Fabbio, C. Ferrari, P. Giordano, E. Magnani, A. Marchetto, G. Matteucci, C. Mazzali, G. Mecella, R. Mosello, R. Nibbi, B. Petriccione, E. Pompei, F. Riguzzi, G. Scarascia-Mugnozza, M. Tita, The Integrated and Combined (I&C) Evaluation System – Achievements, Problems and Perspectives. *Annali dell'Istituto Sperimentale per la Selvicoltura*, volume 30, pp. 151-156, 1999.
See www.corpoforestale.it/flex/cm/pages/ServeAttachment.php/L/IT/D/D.c8dc2e20c6ec76375728/P/BLOB%3AID%3D1017

Books

1. Albeverio S., Andrey D., Giordano P., Vancheri A. (Eds.) (2007) *The Dynamics of Complex Urban Systems. An Interdisciplinary Approach*. Springer, Berlin Heidelberg New York. Proceedings of the conference held in Monte Verità (Ascona) 4-6 November 2004, 350 pages, Physica-Verlag Heidelberg.
2. Albeverio S., Giordano P., Vancheri A. (2020) *Metodi e modelli matematici per le dinamiche urbane*. To appear in the Unitext series of Springer Verlag Italy.

Contributions to conferences and invited lectures

1. Speaker at the conference “GF 2020”, September 2020, Ghent University; title: “Recent results in generalized smooth functions theory”.
2. Invited speaker at the conference “Souriau 2019”, May 27-31 2019, Paris-Diderot University; title: “The Grothendieck topos of generalized functions”.
3. Speaker at the conference “MLFTA 18”, University of Torino, July 2018; title: “The Grothendieck topos of generalized functions”.
4. Speaker at the conference “ISAAC 2017”, Linnaeus University (Sweden), August 2017; title: “A Picard-Lindelöf theorem for singular nonlinear PDE”.
5. Invited talk at Institute for Scientific Interchange (ISI), Turin, 30 November 2016, “MaTryCS - A mathematical theory of complex systems”.
6. Speaker at the workshop WING 2016, June 29 – July 3, 2016, University of Innsbruck, Austria. Title: “Some ideas on generalized smooth functions”.
7. Invited speaker at the “Mini-workshop sulle matematiche non-Archimedee”, University of Pisa, January 22, 2015: title: “Reali di Fermat”.
8. Invited talk at the University of Pisa, January 21, 2015: title: “Funzioni lisce generalizzate”.
9. Speaker at the conference “Generalized Functions 2014”, Southampton, UK, September 8 - 12, 2014. Title: “Unifying order structures for Colombeau algebras”.
10. Invited talk at the conference “13th International Conference on p-adic Functional Analysis”, Paderborn, Germany, August 12–16, 2014. Title: “Theory of infinitely near points in smooth manifolds: the Fermat functor”.
11. Invited opening talk at the workshop “Workshop on diffeologies etc”, Aix en Provence, France, June 25 - 27, 2014. Title: “Theory of infinitely near points in smooth manifolds: the Fermat functor”.
12. Speaker at the conference “18th ÖMG Congress and Annual DMV Meeting”, Innsbruck, September 23 – 27, 2013; title: “Theory of infinitely near points in smooth manifolds: the Fermat functor”.
13. Invited speaker at the University of Bonn, May 28, 2013; title: “Generalized functions as a category of smooth set-theoretical maps”.
14. Speaker at the conference “9th International ISAAC Congress”, August 5-9, 2013, Krakow, Poland; title: “Generalized functions as a category of smooth set-theoretical maps”.
15. Speaker at the conference “XXII St. Petersburg Summer Meeting in Mathematical Analysis”, St. Petersburg, Russia, June 25-30, 2013; title: “Generalized functions as a category of smooth set-theoretical maps”.
16. Invited plenary lecture at the conference “Algebra, Geometry and Mathematical Physics”, Brno, Czech Republic, September 12-14, 2012; title: “Infinitesimal without Logic”.

17. Speaker at the conference “PDE, Microlocal and Time-frequency Analysis”, Novi Sad, Serbia, September 3-8, 2012; title: “Generalized functions as a category of smooth set-theoretical maps”.
18. Speaker at the conference “Mathematical Logic and General Topology”, Novi Sad, Serbia, September 5-8, 2012; title: “Ultrafilter sets smaller than their complements”.
19. Speaker at the conference “XVII Geometrical Seminar”, Zlatibor, Serbia, September 3-8, 2012; title: “Theory of infinitely near points in smooth manifolds: the Fermat functor”.
20. Invited speaker at the symposium "Theories of Continua: Logical and Philosophical Reflections" as part of the 14th *Congress of Logic, Methodology and Philosophy of Science* in Nancy, France, July 2011; title: “Knowledge comes from the dialectic between two worlds: the case of Fermat reals”.
21. Speaker at the conference “Generalized functions 2011”, Fort de France, Martinique, April 2011; Title: “Interacting worlds: transfer of ideas from Fermat ring to Colombeau’s ring”.
22. Invited lecturer at the course “Metodi matematici per la progettazione” of Prof. E. Marchetti, Polytechnic of Milan. Title: “Evidence based design: ovvero le interazioni tra matematica e urbanistica”. Milan, December 2009.
23. Speaker at the conference “Logic and Mathematics”, York, August 2009; title: “Fermat reals: An example of dialogue between formalism and intuition”.
24. Invited speaker at the colloquium of the Interdisziplinäre Zentrum für Komplexe Systeme (IZKS, Bonn, Germany), June 2009; title: “Dynamics of cities: A mathematical planning tool for shopping malls”.
25. Invited speaker at the conference “INPUT08”, Lecco, March 2009; title: “Planning of a complex system: the problem of big traffic generators”.
26. Invited lecturer at the course “Metodi matematici per la progettazione” of Prof. E. Marchetti, Polytechnic of Milan. Title: “Matematica dei sistemi complessi e decisioni in urbanistica”. Milan, November 2008.
27. Invited speaker at the conference “S4 modeling tour”, Milan, April 2008; title: “Interaction Spaces: a language for the collaboration between MAS and hard sciences”.
28. Speaker at the conference “Innovation for Sustainable Production 2008”, i-SUP 2008, April, 22-25, 2008, Bruges, Belgium; title: “A mathematical model of complex mobility patterns for big traffic generators competition and sustainability”.
29. Invited speaker at the conference VIIth AESOP workshop, Thematic Group on Planning and Complexity, Milan, 22 - 23 February 2008; title: “Interaction Spaces Theory: modeling complex systems with the details of MAS and the mathematics of Synergetics”.
30. Invited lecturer at the course “Metodi matematici per la progettazione” of Prof. M.S. Vianello, Polytechnic of Milan. Title: “Supporto alle decisioni in urbanistica mediante modello matematico”. Milan, November 2006.
31. Invited speaker at the conference “Systemic approach and microscale urban complexity”, February 2006; title: “Interaction Spaces: cellular automata + multi-agents models with sound mathematical properties”.
32. Invited speaker at the conference “Herbsttagung Schweizerische Mathematische Gesellschaft”, Lugano, 22-24 September 2005; title: “A mathematical model of urban systems”.
33. Speaker at the conference “Computer in Urban Planning and Urban Management”, London, July 2005; title: “Continuous valued cellular automata and decision processes of agents for urban dynamics”.
34. Invited speaker at the Bonn International Graduate School seminars, July 2003; title: “Infinitesimal Differential Geometry”.

35. Invited speaker at the conference “I numeri infinitesimi – Aspetti storici, filosofici, scientifici e didattici di una grande controversia”, Pisa November 2002; title: “Infinitesimi nilpotenti: metodo e creatività”.
36. Invited speaker at the Institute of Applied Mathematics of Bonn in October 2002, title “Differential geometry in spaces of mappings”.
37. Invited speaker at the conference “NSA 2002”, satellite conference of the meeting UMI-AMS, Pisa, June 2002. Title “‘Standard infinitesimals’: actual nilpotent infinitesimals in standard analysis”.
38. Invited speaker at the University of Trento (I), March 2001. Title: “Geometria Differenziale con infinitesimi nilpotenti”.
39. Speaker at the conference “Quantitative methods for applied sciences” Siena, June 2000. Title: “Quantifying changes in ecosystem status as measured by multiple indicators”.
40. Invited speaker at the “Workshop multitematico in Fisica e Matematica”, 9th September 2000, CERFIM Locarno (CH). Title: “Nilpotent infinitesimals in differential geometry, analysis and physics”.
41. Invited speaker at the Institute of Applied Mathematics of Bonn in June 1999, title “Nilpotent infinitesimals in infinite dimensional differential geometry”.
42. Speaker at the conference “Reuniting the antipodes: constructive and non-standard views of the continuum”, Venice, 17-23 May 1999, title “Nilpotent infinitesimals and Synthetic Differential Geometry in classical logic”.
43. Speaker at the conference “Non-standard Analysis and Related Methods” (Oberwolfach, Germany), February 1999, title “An extension of the hyperreals with nilpotent infinitesimals”.

Description of the presented articles

The main AMS classifications of my papers are in *functional analysis* and in *global analysis, analysis on manifolds*. My recent production of papers amount to 12 papers (total 337 pages) since 2014.

1. **Lecke, Luperi Baglini, Giordano - The classical theory of calculus of variations for generalized functions**
Journal: Advances in Nonlinear Analysis
IF 2018: 6.636
AMS classification: Calculus of variations and optimal control, optimization; Generalized functions for nonlinear analysis; Local Riemannian geometry
Description: We develop an extension of the classical theory of calculus of variations to a class of generalized functions which includes Schwartz distributions: Euler–Lagrange equations, classical necessary and sufficient conditions to have a minimizer, the necessary Legendre condition, Jacobi’s theorem on conjugate points and Noether’s theorem. We close with an application to low regularity Riemannian geometry.
2. **Giordano, Luperi - The category of Colombeau algebras**
Journal: Monatshefte für Mathematik
IF 2018: 0.807
AMS classification: Generalized functions for nonlinear analysis; Category theory
Description: we defined studied Colombeau AG-algebras, which generalize several Colombeau different constructions. The main aim is to study suitable functors to relate differential equations framed in algebras having different growth scales (not only polynomial growth, like in the classical Colombeau algebra).
3. **Giordano, Kunzinger - Inverse Function Theorems for Generalized Smooth Functions**
Chapter in: Operator Theory: Advances and Applications
AMS classification: Functional analysis; Generalized functions for nonlinear analysis.
Description: we prove both local and some global (1-dimensional, Hadamard, Hadamard-Lévy) versions of the inverse function theorem for a class of generalized functions which includes Schwartz distributions.

4. **Giordano, Kunzinger - A convenient notion of compact set for generalized functions**
Journal: Proceedings of the Edinburgh Mathematical Society
IF 2018: 0.61
AMS classification: Generalized functions for nonlinear analysis; Functional analysis (Spaces defined by inductive or projective limits).
Description: We introduce the notion of functionally compact sets into the theory of nonlinear generalized functions in the sense of Colombeau. We then introduce spaces of functionally compactly supported generalized smooth functions that are close analogues to test function spaces of distribution theory. We then develop the topological and functional-analytic foundations of these spaces.

5. **Giordano, Wu - Calculus in the ring of Fermat reals. Part I - Integral calculus**
Journal: Advances in Mathematics
IF 2018: 1.435
AMS classification: Calculus of functions on infinite-dimensional spaces; global analysis, analysis on manifolds; non-Archimedean functional analysis.
Description: This is the last of four papers aiming at study functions and operators in non-normable infinite dimensional spaces (e.g. spaces of smooth functions between non-compact smooth manifolds). The methods used are typical of non-Archimedean functional analysis and convenient vector spaces theory of P.W. Michor, A. Kriegl. The basic idea, which originates from A. Weil, is to first extend \mathbb{R} into a non-Archimedean ring $\bullet\mathbb{R} \supseteq \mathbb{R}$ called ring of Fermat reals. Then every smooth function $f \in \mathcal{C}^\infty(\mathbb{R}^n, \mathbb{R}^d)$ can be extended to a map of the type $\bullet f : \bullet\mathbb{R}^n \longrightarrow \bullet\mathbb{R}^d$, and this extension has good categorical property (Cartesian closedness, i.e. closure with respect to function spaces) to which methods similar to those used in convenient vector spaces can be applied. In this paper we prove existence and uniqueness of primitives and we study smoothness of infinite-dimensional integral and differential operators in suitable non-normable infinite dimensional spaces (e.g. in $\mathcal{C}^\infty(M, N)$, where M, N are smooth manifolds).

6. **Giordano, Luperi - Asymptotic gauges-Generalization of Colombeau type algebras**
Journal: Mathematische Nachrichten
IF 2018: 0.847
AMS classification: Generalized functions for nonlinear analysis; Ordinary differential equations.
Description: We generalize the construction of algebras of nonlinear generalized functions of Colombeau type so as to include the special, full and nonstandard analysis based Colombeau type algebras in a unique general definition. In this setting, every linear ODE with singular coefficients can be uniquely solved. This marks a main difference with the Colombeau special algebra, where only particular linear ODEs can be solved (those of logarithmic type).

7. **Giordano, Kunzinger, Vernaev - Strongly internal sets and generalized smooth functions**
Journal: Journal of Mathematical Analysis and Applications
IF 2018: 1.188
AMS classification: Generalized functions for nonlinear analysis; Functional analysis.
Description: We introduce and study the space of generalized smooth functions, a minimal extension of Colombeau generalized functions, and hence of Schwartz distributions. Generalized smooth functions as morphisms between sets of generalized points form a sub-category of the category of topological spaces. In particular, they can be composed unrestrictedly. As a consequence, this allows one to consider the composition of two arbitrary Schwartz distributions (such as, e.g., $\delta \circ \delta$). Therefore, in this setting the notions of strong and weak solution for a differential equation are equivalent and nonlinear operations on Schwartz distributions are possible (even of non polynomial type).

8. **Giordano, Kunzinger - New topologies on Colombeau spaces and the Fermat-Reyes theorem**
Journal: Journal of Mathematical Analysis and Applications
IF 2018: 1.188
AMS classification: Generalized functions for nonlinear analysis; Functional analysis.
Description: We introduce and study new topologies on spaces of Colombeau generalized points. Building on a new point value characterization of Colombeau generalized functions, we prove a Fermat-Reyes theorem

(also called Carathéodory's differentiation criterion) that forms the basis of an approach to differentiation on spaces of generalized functions close to the classical one.

9. **Giordano, Kunzinger - Topological and algebraic structures on the ring of Fermat reals**

Journal: Israel Journal of Mathematics

IF 2018: 0.764

AMS classification: Calculus of functions on infinite-dimensional spaces; non-Archimedean functional analysis; Fractional derivatives and integrals.

Description: This is the third of four papers aiming at study functions and operators in non-normable infinite dimensional spaces (see above the description of paper 5). In this paper we study two topologies related to differentiation of functions on the non-Archimedean ring of Fermat reals with applications to fractional derivatives.

10. **Giordano - Fermat-Reyes method in the ring of Fermat reals**

Journal: Advances in Mathematics

IF 2018: 1.435

AMS classification: Calculus of functions on infinite-dimensional spaces; global analysis, analysis on manifolds; non-Archimedean functional analysis.

Description: This is the second of four papers aiming at study functions and operators in non-normable infinite dimensional spaces (see above the description of paper 5 above). In this paper we introduce the Cartesian closed category where to prove the Fermat-Reyes theorem (also called Carathéodory's differentiation criterion). This key theorem is essential in the study of infinite-dimensional differential and integral operators in non-normable spaces.

11. **Giordano - Infinite dimensional spaces and Cartesian closedness**

Journal: Journal of Mathematical Physics, Analysis, Geometry

IF 2018: 0.424

AMS classification: Global analysis, analysis on manifolds; Differential geometry (Applications to physics); Group structures and generalizations on infinite-dimensional manifolds; Methods of category theory in functional analysis.

Description: Starting from the failures presented by classical Banach manifolds, we review the most studied approaches focusing on Cartesian closedness: convenient vector spaces theory, diffeology and synthetic differential geometry. In the second part of the paper, we present a general settings to obtain Cartesian closedness (closure with respect to function spaces) as used, e.g., in calculus of variations.

12. **Giordano - The ring of Fermat reals**

Journal: Advances in Mathematics

IF 2018: 1.435

AMS classification: Calculus of functions on infinite-dimensional spaces; non-Archimedean analysis

Description: This is the first of four papers aiming at study functions and operators in non-normable infinite dimensional spaces (see above the description of paper 5). In this paper, we introduce and study the non-Archimedean ring of Fermat reals, which will serve as a base for the searched infinite-dimensional calculus in non-normable spaces.

Preprints and articles in preparation

The publication of the following articles is planned in 2020.

Submitted papers:

1. Mukhammadiev, A., Tiwari, D., Apaaboah, G., Giordano, P., Supremum, Infimum and and hyperlimits of Colombeau generalized numbers, 2020.
2. Tiwari, D., Giordano, P., Hyperseries of Colombeau generalized numbers, 2020.
3. Gastão, S.F., Bryzgalov, A., Giordano, P., Higher order calculus of variations for generalized functions, 2020.

In preparation:

1. Apaaboah, G., Giordano, P., Classical finite dimensional fixed point methods for generalized functions.
2. Bryzgalov, A., Giordano, P., Infinitesimal and infinite numbers in mathematical physics.
3. Giordano, P., Interaction spaces: towards a universal mathematical theory of complex systems.
4. Giordano, P., Kunzinger M., Vernaev H., A Grothendieck topos of generalized functions I: basic theory.
5. Giordano P., Luperi Baglini L., A Grothendieck topos of generalized functions III: normal PDE.
6. Luperi Baglini, L., Giordano, P., A Grothendieck topos of generalized functions II: ODE.
7. Mukhammadiev, A., Giordano, P., A Fourier transform for all generalized functions.
8. Tiwari, D., Giordano, P., Hyper-power series as generalized smooth functions.

Collaboration with the University of Vienna

As described in the link “*Application to FWF project from abroad*” in [URL](#), for the next seven years I can apply as principal investigator of FWF stand-alone projects, even if I will be affiliated to non-Austrian University. Although overheads of these projects remain at the University of Vienna, I can use this funding for PhD and post-doc salaries. These researchers have to work on project related topics, but clearly they can also work on different independent subjects with professors affiliated to this non-Austrian University. After these seven years, I can continue to apply as co-author for this type of FWF funding (with the same rights to employ researchers) thanks to all the collaborations started in these years at the University of Vienna. At present, my research projects have been funded for about 2 million of Euro from 2002 to 2020.

Present FWF projects under reviewing

1. ***Applications of generalized smooth functions***. Co-authors: M. Kunzinger (University of Vienna).
The main aim of the proposed project is to develop several applications in the framework of generalized smooth functions (Colombeau’s theory), where new general existence results was recently proved, such as the Banach fixed point theorem (both for singular nonlinear ODE and PDE with loss of derivatives) and a Picard-Lindelöf theorem for PDE. We plan to develop: finite and infinite-dimensional Newton’s method for generalized functions, Pontryagin’s principle, singular Hamiltonian mechanics, numerical representation of generalized smooth functions.
Requested support: 400’000 Euro. Final FWF decision on October 2020.

URL

1. My projects on FWF website
<https://pf.fwf.ac.at/de/wissenschaft-konkret/project-finder?search%5Bwhat%5D=Giordano+Paolo>
2. My projects on USI website 1
<https://search.usi.ch/it/progetti/236/Supporto-alle-decisioni-basato-su-modello-matematico-per-il-problema-dei-gra>
3. My projects on USI website 2
<https://search.usi.ch/it/progetti/288/effects-of-neighborhood-choice-on-housing-markets-a-model-based-on-the-inter>
4. My projects on SNF website <http://p3.snf.ch/person-138211-Giordano-Paolo>
5. FWF web page: *Application to FWF project from abroad*
<https://www.fwf.ac.at/en/research-funding/applications-from-abroad/>