Curriculum Vitae
Bruno Martelli

Personal data

Born in Arezzo, Italy on April 9, 1973. Citizenships: Italian and French.

Full Professor at Dipartimento di matematica, Università di Pisa.

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Web page: `people.dm.unipi.it/martelli`

Employment

2001 – 2003. Università di Pisa, Postdoc.

2004 – 2014. Università di Pisa, Assistant Professor (Ricercatore) in geometry.

2014 – 2016. Università di Pisa, Associate Professor in geometry.

2016 – now. Università di Pisa, Full Professor in geometry.

Education

1992 – 1996. Università di Pisa, laurea in matematica *cum laude*, thesis *Invarianti di Turaev-Viro*, supervised by Carlo Petronio.

1992 – 1996. Scuola Normale Superiore di Pisa, graduated *cum laude*.

1996 – 1997. Istituto Nazionale di Alta Matematica in Rome.

1997 – 2001. Università di Firenze, dottorato in matematica, thesis *Complexity of three-manifolds*, supervised by Carlo Petronio and Wolfgang Metzler.

Awards

2023. *Frontiers of Science Award* for the paper [38], assigned at the first ICBS in Beijing.

Visiting periods

December 1994. École Normale de Paris.

October – December 1995. St. John's College, Oxford.

March – June 2000. Goethe-Universität Frankfurt.

March 2003. University of Texas, Austin.

March 2010. *Professeur invité*, IRMA Strasbourg.

March 2012. Institut Henri Poincaré, Paris.

May – June 2013. *Professeur invité*, IRMA Strasbourg.

May 2015. *Professeur invité*, Université Paul Sabatier, Toulouse

Teaching

Courses

I have taught various courses, mostly in geometry but also in analysis and algebra, in Pisa at the following departments: Engeneering, Physics, Maths, Computer Science. Details starting from 2003/04 available from

`http://people.dm.unipi.it/martelli/didattica.html`

Thesis supervised

Degree thesis

November 2006. Abramo Bertucco, *Curve tropicali.*

February 2007. Leone Slavich, *Decomposizione per somma connessa di 3-varietà.*

May 2007. Marco Golla, *Varietà tropicali.*

September 2007. Claudio Tamburrino, *Coomologia della grassmanniana.*

July 2008. Mario Luca Scarascia, *Il polinomio di Alexander.*

March 2009. Fabio Lilliu, *Teorema di normalizzazione e Riemann-Roch.*

July 2009, Marco Antognozzi, *Introduzione alla teoria di Morse.*

October 2009, Francesca Iezzi, *Il polinomio di Jones e i link alternati.*

March 2010. Daniele Celoria, *Costruzione di Pontryiagin e gruppi di omotopia delle sfere.*

June 2010. Francesco Lin, *K-teoria complessa e invariante di Hopf.*

June 2010. Nicolas Matte Bon, *Foliazioni di 3-varietà in codimensione uno: il teorema di Novikov.*

September 2011. Omar Quilici, *Omologia singolare e grado topologico.*

June 212. Fabio Gironella, *Foliazioni misurate su superfici e teoremi di classificazione.*

July 2013. Michele Ancona, *Coomologia di SO(n).*

July 2013. Elena Giorgi, *Le classi di Stiefel-Whitney.*

December 2013. Irene Barbensi, *Il teorema di Lickorish-Wallace.*

May 2016. Alessandro Terni, *Teoria di Morse.*

June 2016. Irene Filoscia, *Decomposizione di 3-varietà in fattori primi.*

May 2018. Laura Salvetti, *Superfici singolari in una 3-varietà: il lemma di Dehn e il teorema del loop.*

December 2020. Filippo Paiano, *Classi caratteristiche e teoria di Chern-Weil.*

Master thesis

November 2009. Claudio Tamburrino, *L'omologia di Khovanov.*

October 2010. Mario Scarascia, *Superfici quasi-geodetiche in 3-varietà iperboliche.*

October 2014. Marco Antognozzi, *La caratterizzazione di Rivin dei poliedri iperbolici di volume finito.*

October 2015. Giulio Belletti, *The generalized Witten asymptotics conjecture.*

October 2016. Fabio Lilliu, *Immersioni di superfici in 3-varietà iperboliche chiuse.*

October 2018. Ludovico Battista, *Principal congruence link complements.*

March 2019. Andrea Parma, *Geometric structures on manifolds: transitions from hyperbolic to anti-de Sitter geometry.*

September 2019. Dario Ascari, *Strutture iperboliche su fibrati in piani su superfici.*

September 2019. Matteo Migliorini, *Taut foliations on 3-manifolds.*

October 2019. Diego Santoro, *Hyperbolic four-manifolds with vanishing Seiberg-Witten invariants.*

October 2019. Giovanni Italiano, *Trisections of 4-manifolds.*

December 2019. Elia Miranceli, *Link alternati debolmente generalizzati.*

December 2020. Simone Cappellini, *Fibrations and congruence towers of arithmetic hyperbolic manifolds.*

December 2020. Giulio Loddi, *Bridge trisections of knotted surfaces.*

May 2021. Viola Giovannini, *Rigidity of hyperbolic manifolds with geodesic boundary in dimension $n \geq 4$.*

October 2021. Edoardo Rizzi, *Conteggio di superfici essenziali in una 3-varietà.*

October 2021. Jacopo Guoyi Chen, *Le norme di Thurston e di Alexander.*

October 2021. Andrea Egidio Monti, *Earthquake and horocycle flows over Teichmüller space.*

December 2021. Tobia Trinci, *Varietà propriamente convesse e decomposizione di Epstein-Penner.*

September 2022. Gemma Di Petrillo, *Varietà dei caratteri del nodo figura-8 a valori in* $\mathrm{SL}_3(\mathbb{C})$.

July 2023. Manuel Berbenni, *Il teorema di Nielsen-Thurston di classificazione degli omeomorfismi di superfici.*

September 2023. Guido Borgianni, *Caratterizzazione topologica delle funzioni razionali.*

September 2023. Alessandro Cigna, *Il Teorema di iperbolizzazione per le 3-varietà che fibrano sul cerchio.*

October 2023. Irene Pisapia, *Hyperbolization procedures for cell complexes.*

PhD thesis

October 2011. Fionntan Roukema, *Dehn Surgery on the minimally twisted five-chain link.* (co-supervised with Carlo Petronio)

April 2014. Leone Slavich, *Hyperbolic 4-manifolds and 24-cells.*

October 2016. Alessio Carrega, *Shadows and quantum invariants.*

May 2017. Stefano Riolo, *Cone-manifolds and hyperbolic surgeries.*

September 2020. Giulio Belletti, *Asymptotic behavior of quantum invariants.* (co-supervised with Francesco Costantino)

July 2021. Leonardo Ferrari, *Hyperbolic manifolds and coloured polytopes.*

April 2022. Ludovico Battista, *Hyperbolic 4-manifolds, perfect circle-valued Morse functions and infinitesimal rigidity.*

December 2023. Matteo Migliorini, *Bestvina–Brady Morse theory on hyperbolic manifolds.*

December 2023. Diego Santoro, *L-spaces and taut foliations on 3-manifolds.* (co-supervised with Paolo Lisca)

February 2024. Giovanni Italiano, *Fibering hyperbolic manifolds and hyperbolic groups.*

Ongoing, started 2021. Jacopo Guoyi Chen.

Ongoing, started 2021. Viola Giovannini. (co-supervised with Jean-Marc Schlenker)

Ongoing, started 2022. Gemma Di Petrillo.

Post-docs supervised

2013 – 2015. Delphine Moussard.

2014 – 2015. Marco Golla.

2016 – 2018. Leone Slavich.

2016. Matthieu Gendulphe.

2017, 2020. Stefano Riolo.

2024 – 2025. Filippo Sarti.

Talks

Conferences

August 1997. "Encoding spines of 3-manifolds via o-graphs",
Low-dimensional topology and combinatorial group theory, Luttach.

August 1999. "Tori and minimal spines of 3-manifolds",
Low-dimensional topology and combinatorial group theory, Chelyabinsk.

August 2001. "Complexity of 3-manifolds and decompositions along tori",
Low-dimensional topology and combinatorial group theory, Luttach.

June 2002. "Complexity of 3-manifolds and decompositions along tori",
AMS-UMI joint meeting, Pisa, Italy, session on the topology of 3-manifolds.

September 2002. "Riconoscere varietà ottenute con chirurgia di link in S^3",
Proprietà geometriche dell varietà reali e complesse: nuovi contributi italiani III, Palermo.

September 2003. "Complessità di n-varietà triangolabili",
Congresso UMI, Milan, session on the topology and geometry of manifolds.

May 2004. "Complexity of PL n-manifolds",
INTAS workshop on 3-manifolds, Edernburg.

February 2005. "Links, two-handles, and complexity of 4-manifolds",
Workshop on 3-manifolds and complexity, Cortona.

June 2005. "2-polyhedra in 4-manifolds",
AMS-DMV-ÖMG joint meeting, Mainz, session on geometric topology & group theory.

June 2005. "Dehn surgery on links in 3-manifolds",
Summer school and conference on geometry and topology of 3-Manifolds, Trieste.

May 2007. "Complexity ad decompositions of PL-manifolds",
Braids and their ramifications, Cortona.

December 2010. "Turaev-Viro representations of the mapping class groups",
De Brun workshop, Galway.

May 2012. "Stable complexity and simplicial volume of manifolds",
Triangulations, Oberwolfach.

June 2013. "From cubulations to cusped hyperbolic 4-manifolds",
Low-dimensional topology and geometry in Toulouse, Toulouse.

July 2014. "Hyperbolic 4-manifolds constructed via right-angled polytopes",
RSME-SCM-SEMA-SIMAI-UMI joint meeting, Bilbao, session on geometric topology.

March 2015. "Varietà iperboliche di dimensione 4",
Varietà reali e complesse: geometria, topologia e analisi armonica, SNS Pisa.

May 2015. "Quantum representations of the mapping class group",
Chromatic and colored structures in geometry and statistical physics, Cortona.

June 2015. "Constructing hyperbolic four-manifolds",
New Perspectives on the Interplay between Discrete Groups in Low-Dimensional Topology and Arithmetic Lattices, Oberwolfach.

July 2015. "An analytic family of reprs for the mapping class group of punctured surfaces",
New developments in TQFT, QGM Aarhus.

August 2016. "Hyperbolic Dehn filling in dimension four",
1st joint meeting Brazil–Italy in mathematics, IMPA Rio de Janeiro.

September 2017. "Hyperbolic Dehn filling in dimension four",
Geometric topology in low dimensions, Warwick.

December 2017. "Shadow complexity of smooth closed four-manifolds",
Computation in geometric topology, Warwick.

February 2018. "Shadow complexity of smooth closed four-manifolds",
Knotted embeddings in dimensions 3 and 4, Luminy.

July 2018. "Hyperbolic Dehn filling in dimension four",
Growth in Topology and Number Theory: Volumes, Entropy, and L2-torsion, Bonn.

June 2019. Minicourse on "The geometry of 3-manifolds",
Géométrie, topologie et arithmétique de façon hyperbolique, Les Diablerets.

July 2021. "Hyperbolic manifolds that fiber over the circle",
Real and complex manifolds. The mathematical heritage of Edoardo Vesentini, Pisa.

January 2022. "Hyperbolic 5-manifolds that fiber over the circle ",
Geometry Winter Workshop in Luxembourg, Luxembourg.

May 2022. Minicourse on "Rigidity of hyperbolic manifolds",
Graduate school on Geometric Group Theory and Low Dimensional Topology, Madrid.

June 2022. "Hyperbolic 5-manifolds that fiber over the circle",
Geometry, Arithmetic, and Groups, Austin TX.

May 2023. "On subgroups of a hyperbolic group",
Geometry of Subgroups, Montreal.

June 2023. "Fibering hyperbolic manifolds",
Interactions entre géométrie et topologie, en l'honneur d'Ivan Babenko, Banyuls.

July 2023. "Hyperbolic manifolds",
International Congress on Basic Science, Beijing.

August 2023, "A curious 4-dimensional aspherical manifold",
Braids meeting 2023 – Surfaces and manifolds in dimension 4, Marseille.

March 2024, "Negatively curved spaces obtained via branched coverings over a torus",
Topological and Homological Methods in Group Theory 2024, Bielefeld.

Seminar talks

May 2009. "Complessità di varietà triangolabili", Università di Bologna.

June 2009. “Ombres de Turaev sans sommets”, Strasbourg IRMA.
March 2010. “Épines 3-dimensionnelles de 4-variétés”, Strasbourg IRMA.
January 2011. “Turaev-Viro repr. of the mapping class groups”, Strasbourg IRMA.
April 2013. “Une famille analytique de repr. pour le groupe modulaire”, Paris Jussieu.
May 2013. “Une famille analytique de repr. pour le groupe modulaire”, Strasbourg IRMA.
May 2013. “Quantum representations of mapping class groups”, Paris Orsay.
February 2014. “Combinatorial constr. of hyperbolic/Einstein 4-manifolds”, MIT Boston.
February 2014. “Combinatorial constr. of hyperbolic/Einstein 4-mfds”, Brown University.
May 2014. “Constructions of hyp. manifolds from regular polytopes”, Université de Fribourg
May 2015. “Constructions de variétés hyperboliques en dimension 4”, Université de Toulouse.
November 2016. “Hyperbolic Dehn filling in dimension four”, Universität Regensburg.
November 2016. “The geometrisation of three-manifolds”, Universität Regensburg.
November 2016. “Hyperbolic cone-manifolds in dimension four”, Uppsala University.
June 2017. “Geometrisation of three-manifolds”, Universität Heidelberg.
November 2017. “Hyperbolic Dehn filling in dimension four”, University of Luxembourg.
February 2019. “Variétés hyperboliques compactes sans structure spin”, Paris Jussieu.
June 2020. “Convex hyperbolic 4-manifolds”, [K-OS] Knot On line Seminar.
February 2021. “Hyperbolic 4-manifolds”, Tufts University on line GGTT Seminar
June 2021. “Hyperbolic 5-manifolds that fiber”, University of Chicago (on line).
July 2021. “Hyperbolic 5-manifolds that fiber”, Universität Münster (on line).
October 2021. “Hyperbolic 5-manifolds that fiber”, IYSBCSV (on line).
October 2021. “Hyperbolic groups with non-hyp. subgroups of finite type”, GGSE (on line).
October 2021. “The geometry and topology of 3-manifolds”, SISSA Trieste.
November 2021. “Hyperbolic 5-manifolds that fiber”, Oxford University (on line).
November 2021. “Hyperbolic manifolds of dimension > 3”, Karlsruhe Institut of Technology.
February 2022. “Hyperbolic 5-manifolds that fiber over the circle”, UC Davis (on line).
March 2022. “Fibrations on hyperbolic manifolds”, Fudan University Shanghai (on line).
November 2022. “Variétés hyperboliques qui fibrent en dimension 5”, Paris Jussieu.
November 2022. “Variétés hyperboliques qui fibrent en dimension 5”, Université de Lille.
December 2022. “Shadows of 3- and 4-manifolds,” Università di Modena (on line)
December 2022. “Variétés hyperboliques qui fibrent”, Séminaire francophone G&G (on line).
October 2023. “Varietà iperboliche”, Università di Bologna.
October 2023. “Hyperbolic manifolds”, University of Durham.
October 2023. “Hyperbolic 5-manifolds that fiber over the circle”, University of Durham.
December 2023. “Varietà iperboliche”, Università di Trento.

Outreach

February 2022. "Geometria e topologia", 3 lessons for high school teachers, *Matematica nel mondo contemporaneo*, Accademia dei Lincei e Normale per la Scuola.

Organizational activities

Research projects

I have been the Principal Investigator of the following projects:

2004 – 2005. *Flusso di Ricci su* 3*-varietà*, funded by INdAM.

2011 – 2015. *Geometry and topology of low-dimensional manifolds*, FIRB funded by the Italian Government; budget: 610.000 euros.

2016 – 2018. *Geometria e topologia delle varietà*, PRA funded by the University of Pisa; budget: 40.000 euros.

2018 – 2020. *Geometria e topologia delle varietà*, PRA funded by the University of Pisa; budget: 33.000 euros.

2023 – 2025. *Geometry and topology of manifolds*, PRIN funded by the Italian Government; budget: 187.500 euros.

Conferences (co-)organized

June 2013. INdAM workshop *Geometric topology in Cortona*, Cortona.

June 2013. Mini-workshop *Hyperbolic geometry and mapping class groups*, Pisa.

May – June 2014. Intensive month *Teichmüller theory and surfaces in 3-manifolds*, Centro De Giorgi (Pisa).

June 2016. Two-weeks *School on Geometric Group Theory and Low-Dimensional Topology: Recent Connections and Advances*, ICTP Trieste.

June 2017. INdAM workshop *Geometric topology in Cortona*, Cortona.

September 2023. Sessione *Topologia e geometria differenziale* del XXII Convegno UMI, Pisa.

June 2024. Conference *Combinatorial and Gauge theoretical methods in low dimensional topology and geometry*, Centro De Giorgi (Pisa).

Refereeing

2002 – today. Referee for various journals and PhD thesis.

References

Books

[1] B. Martelli, "An Introduction to Geometric Topology", 480 pages, CreateSpace Independent Publishing Platform, 2016.

[2] B. Martelli, "Geometria e algebra lineare", 444 pagine, 109 figure, Independently published, 2018.

Papers

[3] B. Martelli, *Minimal spines and geometric decompositions of closed 3-manifolds*, in "Low-dimensional topology and combinatorial group theory (Chelyabinsk 1999)", Inst. of Math. of Nat. Acad. Sci. of Ukraine, Kiev.

[4] B. Martelli – C. Petronio, *Three-manifolds having complexity at most* 9, Experimental Math. **10** (2001), 207-237.

[5] B. Martelli – C. Petronio, *A new decomposition theorem for* 3*-manifolds*, Illinois J. Math. **46** (2002), 755-780.

[6] R. Frigerio – B. Martelli – C. Petronio, *Complexity and Heegaard genus of an infinite class of compact 3-manifolds*, Pacific J. Math. **210** (2003), 283-298.

[7] R. Frigerio – B. Martelli – C. Petronio, *Dehn filling of cusped hyperbolic 3-manifolds with geodesic boundary*, J. Diff. Geom. **64** (2003), 425-456.

[8] G. Amendola – B. Martelli, *Non-orientable 3-manifolds of small complexity*, Topol. Appl. **133** (2003), 157-178.

[9] R. Frigerio – B. Martelli – C. Petronio, *Small hyperbolic 3-manifolds with geodesic boundary*, Experimental Math. **13** (2004), 177-190.

[10] B. Martelli – C. Petronio, *Complexity of geometric three-manifolds*, Geom. Dedicata **108** (2004), 15-69.

[11] G. Amendola – B. Martelli, *Non-orientable 3-manifolds of complexity up to* 7, Topol. Appl. **150** (2005), 179-195.

[12] B. Martelli *Links, two-handles, and four-manifolds*, Int. Math. Res. Not. **58** (2005), 3595-3624.

[13] B. Martelli – C. Petronio, *Dehn filling of the "magic" 3-manifold*, Comm. Anal. Geom. **14** (2006), 967-1024.

[14] B. Martelli *Complexity of 3-manifolds*, "Spaces of Kleinian Groups", London Math. Soc. Lec. Notes Ser. **329** (2006), 91-120.

[15] R. Frigerio – B. Martelli, *Countable groups are mapping class groups of hyperbolic 3-manifolds* Math. Res. Lett. **13** (2006), 897-910.

[16] F. Costantino – R. Frigerio – B. Martelli – C. Petronio, *Triangulations of 3-manifolds, hyperbolic relative handlebodies, and Dehn filling*, Comm. Math. Helv. **82** (2007), 903-934.

[17] E. Fominykh – B. Martelli, *k-Normal surfaces*, J. Diff. Geom. **82** (2009), 101-114.

[18] D. Heard – C. Hodgson – B. Martelli – C. Petronio, *Hyperbolic graphs of small complexity*, Experimental Math. **19** (2010), 211-236.

[19] B. Martelli, *Complexity of PL manifolds*, Algebraic & Geometric Topology 10 (2010), 1107-1164.

[20] B. Martelli, *Four-manifolds with shadow-complexity zero*, Int. Math. Res. Not. **2011** (2011), 1268-1351.

[21] B. Martelli, *A finite set of local moves for Kirby calculus*, J. Knot Theory Ramif. **21** (2012), 1250126.

[22] S. Francaviglia – R. Frigerio – B. Martelli, *Stable complexity and simplicial volume of manifolds*, Journal of Topology **5** (2012), 977-1010.

[23] A. Kolpakov – B. Martelli, *Hyperbolic four-manifolds with one cusp*, Geom. & Funct. Anal. **23** (2013), 1903-1933.

[24] F. Costantino – B. Martelli, *An analytic family of representations for the mapping class group of punctured surfaces*, Geometry & Topology **18** (2014) 1485-1538.

[25] B. Martelli – C. Petronio – F. Roukema, *Exceptional Dehn surgery on the minimally twisted five-chain link*, Comm. Anal. Geom. **22** (2014), 689-735.

[26] A. Kolpakov – B. Martelli – S. Tschantz, *Some hyperbolic three-manifolds that bound geometrically*, Proc. Amer. Math. Soc. **143** (2015), 4103-4111.

[27] A. Carrega – B. Martelli, *Shadows, ribbon surfaces, and quantum invariants*, Quantum Topology **8** (2017), 249-294.

[28] B. Martelli – M. Novaga – A. Pluda – S. Riolo, *Spines of minimal length*, Ann. Sc. Norm. Sup. Pisa Cl. Sci **XVII** (2017), 1067-1090.

[29] M. Golla – B. Martelli, *Pair of pants decomposition of 4-manifolds*, Algebraic & Geometric Topology, **17** (2017), 1407-1444.

[30] B. Martelli, *Hyperbolic three-manifolds that embed geodesically*, `arXiv:1510.06325`.

[31] B. Martelli, *Hyperbolic four-manifolds*, "Handbook of Group Actions, Volume III", Advanced Lectures in Mathematics series 40 (2018), 37-58

[32] B. Martelli – S. Riolo, *Hyperbolic Dehn filling in dimension four*, Geometry & Topology **22** (2018), 1647–1716.

[33] B. Martelli – S. Riolo – L. Slavich, *Compact hyperbolic manifolds without spin structures*, Geometry & Topology **24** (2020), 2647-2674.

[34] B. Martelli – S. Riolo – L. Slavich, *Convex plumbings in closed hyperbolic 4-manifolds*, Geometriae Dedicata **212** (2021), 243–259.

[35] B. Martelli, *Dehn surgery on the minimally twisted seven-chain link*, Comm. Anal. Geom. **29** (2021), 1597–1641.

[36] Y. Koda – B. Martelli – H. Naoe, *Four-manifolds with shadow-complexity one*, Ann. Fac. Sci. Toulouse **31** (2022), 1111–1212.

[37] L. Battista – B. Martelli, *A hyperbolic 4-manifold with a perfect circle-valued Morse function*, Trans. Amer. Math. Soc. **375** (2022), 2597–2625.

[38] G. Italiano – B. Martelli – M. Migliorini, *Hyperbolic 5-manifolds that fiber over S^1*, Invent. Math. **231** (2023), 1–38.

[39] G. Italiano – B. Martelli – M. Migliorini, *Hyperbolic manifolds that fiber algebraically up to dimension 8*, J. Inst. Math. Jussieu **23** (2024), 609–646.

[40] C. Llosa Isenrich – B. Martelli – P. Py, *Hyperbolic groups containing subgroups of type F_3 not F_4*, `arXiv:2112.06531`, accepted for publication in J. Diff. Geom.

[41] B. Martelli – A. Reid, *The Dirac operator on cusped hyperbolic manifolds*, `arXiv:2212.06811`

[42] R. Frigerio – G. Grammatica – B. Martelli, *Efficient cycles of hyperbolic manifolds*, `arXiv:2309.17198`

[43] B. Martelli, *Five tori in the four-dimensional sphere*, `arXiv:2401.03460`

Pisa, March 20, 2024