

Matteo Biagetti

Curriculum Vitae

Current Position

Since 2025 **Staff Researcher**, *Istituto di Ricerca e Innovazione Tecnologica, Area Science Park, Trieste, Italy.*

Previous Positions

- 2023 – 2025 **Fixed-Term Researcher**, *Istituto di Ricerca e Innovazione Tecnologica, Area Science Park, Trieste, Italy.*
- 2020 – 2023 **Postdoctoral fellow**, *Scuola Internazionale Superiore di Studi Avanzati (SISSA), Trieste, Italy.*
Funding: NWO VENI grant (until end 2021)
- 2018 – 2020 **VENI postdoctoral fellow**, *University of Amsterdam, Amsterdam, Netherlands.*
Funding: NWO VENI grant
- 2016 – 2018 **Delta Institute for Theoretical Physics Postdoctoral Fellow**, *University of Amsterdam, Amsterdam, Netherlands.*
Supervisor: Daniel Baumann
- 2016 **Postdoctoral Researcher**, *University of Geneva, Geneva, Switzerland.*
Supervisor: Vincent Desjacques

Education

- 2012–2016 **Ph.D. Theoretical Physics**, *University of Geneva, Geneva, Switzerland.*
Supervisor: Vincent Desjacques
- 2010–2012 **Master's Degree Theoretical Physics**, *University of Padova, Padova, Italy.*
Supervisor: Sabino Matarrese

Research Activity

I work on methods that uncover structure in high-dimensional data. I earned a PhD in theoretical physics and spent several years in theoretical cosmology before moving toward data-driven research. Drawing from physics and mathematics, I use topological and geometric ideas to build machine-learning tools that are easier to interpret and useful in scientific settings—from cosmology to neural representations.

Output indicators. As of January 2026, I have published 38 papers, plus 6 preprints with a citation count of 2158 and an h-index of 26 according to Google Scholar. For a detailed citation record of my papers, see my google scholar profile.

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I have published in high impact factors journals (JCAP, MNRAS, PRD, ApJ, PLB, PRR) and contributed to major ML conferences (ICML, Neurips).

Fellowships and awards

- 2020 – 2030 **Abilitazione Scientifica Nazionale**, *Italian Ministry of Education*, Italy.
Qualified as Associate Professor in Italy
- 2023 – 2025 **SMASH fellowship (declined)**, *Marie Curie COFUND*, University of Nova Gorica , Slovenia.
Amount: 10 Millions Eur
Role: SMASH Fellow
- 2018 – 2022 **VENI grant**, *Netherlands Organization for Scientific Research (NWO)*, Netherlands.
Amount: 250,000 EUR
Role: Principal Investigator
- 2018 – 2021 **Computing Time Grant (3 consecutive years)**, *Netherlands Organization for Scientific Research (NWO)*, Netherlands.
Amount: 2.5 Million CPU hours (total)
Role: Principal Investigator
- Since 2021 **Storage Space at European Open Science Cloud**, *EUDAT*, “Cosmic Origins from Simulated Universes”.
Amount: 100TB
- 2016 – 2018 **Delta Institute for Theoretical Physics Postdoctoral Fellowship**, *Netherlands Organization for Scientific Research (NWO)*, Netherlands.
Amount: 18.3 Million EUR
Role: Postdoctoral researcher
- 2014 – 2015 **Travel funding (2 consecutive years)**, *Ernst et Lucie Schmidheiny foundation*, Switzerland.
Amount: 1,600 EUR
Role: Principal Investigator

International Activities

Selected list of the most recent invited talks

- February 2023 Astrophysics Seminar, Trieste Observatory (Italy)
- January 2023 Theoretical Physics Seminar, LAPTh, Annecy (France)
- May 2022 Physics Colloquium, University of Nova Gorica (Slovenia)
- Nov 2021 Cosmology seminar, ETH Zurich (Switzerland)[remote]
- May 2021 Cosmology seminar, University of Geneva (Switzerland) [remote]
- Nov 2020 Cosmology seminar. Lorentz Institute, Leiden (Netherlands) [remote]
- Oct 2020 AstroCoffee, IAS Princeton (US) [remote]

Selected list of conference/workshop talks

- January 2026 Symposium for Data-Driven Approaches in X-ray Absorption Spectroscopy (DataXAS), ETH Zurich, Switzerland

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- November 2025 Geometry, Topology and Machine Learning Workshop, MPI für Mathematik in den Naturwissenschaften Leipzig, Germany
- July 2025 International Conference on Machine Learning, Vancouver, Canada
- June 2024 Data Science and Fundamental Physics and its bridge to industry and society, Santiago de Compostela (Spain)
- May 2023 DataShape Seminar INRIA @Porquerolles (France)
- Dec 2022 Extracting Reliable Constraints from Large-Scale Structure Surveys, Technion (Haifa)
- Jul 2022 Smartno 2022, Vipolze (Slovenia)
- Dec 2020 Latin American Workshop, Sao Paolo (Brazil) [remote]
- Sep 2019 The non-Gaussian Universe, Cambridge (UK)
- Jun 2019 String Theory and Cosmology, Castelldefels (Spain)

Network of collaborators. I have an international network of collaborators across 3 continents and 30 countries all over the world. I have visited top institutes in the world, such as the *Institute of Advanced Studies* in Princeton, *Berkeley National Laboratory*, *Fermilab*, *Caltech*, *CERN*, *ETH* and *University of Cambridge*, among others.

Students Supervision

- 2024 **Supervision of PhD student in Data Science and Scientific Computing**, *University of Trieste*, Trieste, Italy.
Ph.D. Candidate: Yuri Gardinazzi
- 2024 **Supervision of Master Student in Mathematics**, *University of Trieste*, Trieste, Italy.
Master's Degree Candidate: Giada Panerai
- 2019 **Supervision of visiting PhD student**, *University of Amsterdam*, Amsterdam, Netherlands.
Ph.D. Candidate: Giorgio Orlando (University of Padova)
- 2019 **Supervision of visiting PhD student**, *University of Amsterdam*, Amsterdam, Netherlands.
Ph.D. Candidate: Alex Cole (University of Wisconsin-Madison)

Teaching activities

- 2025 **Master in Data Management and Curation**, *Area Science Park & SISSA*, Trieste, Italy.
Master Course on "Applied AI"
- 2025 **Academic Teaching Assistance**, *Galileo Galilei Institute*, Florence, Italy.
Doctoral course on "Theoretical Aspects of Astroparticle Physics, Cosmology and Gravitation"
- 2024 **Pilot Course in Data Management and Curation**, *SISSA*, Trieste, Italy.
Master Course on "Introduction to Statistical Data Analysis and Machine learning"
- 2018 **Academic Teaching Assistance**, *Galileo Galilei Institute*, Florence, Italy.
Doctoral course on "Theory of fundamental interactions"

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- 2012 – 2016 **Academic Teaching Assistance**, *University of Geneva*, Geneva, Switzerland.
 Bachelor's degree course on "Mathematical Methods for Physics" (3 years in total)
- 2013 **Academic Teaching Assistance**, *University of Geneva*, Geneva, Switzerland.
 Master's degree course on "Cosmology"

Organisation of Scientific Meetings

- July 2024 **Organizer**, *Sexten Center for Astrophysics*, Sexten, Italy.
 Workshop – 40 live participants
 Title: "New Strategies for Extracting Cosmology from Galaxy Surveys - 2nd Edition"
[Link](#)
- July 2023 **Main Organizer**, *Sexten Center for Astrophysics*, Sexten, Italy.
 Workshop – 40 live participants
 Title: "New Strategies for Extracting Cosmology from Galaxy Surveys"
<https://indico.sissa.it/event/93/>
- June 2023 **Main Organizer**, *Institute for Fundamental Physics of the Universe*, Trieste, Italy.
 IFPU Team Research week – 15 live participants, 5 remote participants
 Title: "Applications of Topological Data Analysis to Cosmology and Beyond"
<https://indico.sissa.it/event/100/>
- July 2022 **Main Organizer**, *Institute for Fundamental Physics of the Universe*, Trieste, Italy.
 IFPU Focus week – 25 live participants, 30 remote participants
 Title: "Interpretable and Higher-Order Summary Statistics for Late-Time Cosmology"
<https://indico.sissa.it/event/77/>
- July 2021 **Main Organizer**, *Lorentz Center*, Leiden, Netherlands.
 Lorentz Center Workshop – 25 participants
 Title: "Inflationary Imprints in Large-Scale Structures"
<https://www.lorentzcenter.nl/inflationary-imprints-in-large-scale-structure-2021.html> (later cancelled due to COVID-19)
- 2018-2020 **Main Organizer**, *Netherlands Organization for Scientific Research (NWO)*,
 Netherlands.
 Dutch Cosmology Meeting (6 events/year ~ 30 participants)
<http://cosmology.nl/>

Institutional Responsibilities

- 2023-2024 **Organizer**, *Institute of Research and Technological Innovation*, Trieste, Italy.
 LADE Seminars
- 2023 **Website Developer**, *Hugo software*, Pathogen Readiness Platform website.
- 2023 **Website Developer**, *Hugo software*, Scientific Events in Area Science Park.
- 2020-2021 **Organizer**, *Institute for Fundamental Physics of the Universe*, Trieste, Italy.
 Cosmology and Astrophysics Seminars and Journal Clubs
- 2019 **Member of Ph.D. Defense Committee**, *University of Leiden*, Leiden, Netherlands.
 Ph.D. Candidate: Georgios Papadomanolakis
- 2018 – 2019 **Organizer**, *University of Amsterdam*, Amsterdam, Netherlands.
 Weekly Journal Clubs

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Reviewing Activities

Since 2016 Referee - ICLR, A&A, ApJ, JCAP, MNRAS, PRL, PRD, PRX, PLB

Major Collaborations

Since 2019 Member of Euclid Consortium

Public Outreach

September **Public Talk**, *Trieste Next.*

2025 Title: L'intelligenza artificiale che scrive

May 2024 **Public Talk**, *Pint of Science Trieste.*

Title: Dalle strutture cosmiche all'intelligenza artificiale: un viaggio attraverso le lenti della topologia

July 2019 **Interview**, *National Geographic Magazine (NL)*.

Title: Op zoek naar het begin der tijden, published on the July 2019 issue

2013 - 2016 **Writer**, *Gushmag Social Magazine*, Title: Un caffè col fisico (Italian).

Link: <http://www.gushmag.it/un-caffè-col-fisico/>

2015 - 2016 **Writer**, *UNOX Website*, Title: Science of cooking.

Link: <http://blog.unox.com/category/science-of-cooking/?lang=en>

Oct 2014 **Public Talk**, *Festival Emergency*, Fonderie Kugler, Geneva(CH).

Title: Our Universe in a lifetime

Publications

Legend. Leading contribution is indicated in **bold**. Students supervised for the project are indicated in *italics*.

July 2025 Y. Gardinazzi, K. Viswanathan, G. Panerai, A. Ansini A. Cazzaniga, **M. Biagetti**, “*Persistent Topological Features in Large Language Models*”, Proceedings of the International Conference on Machine Learning 2025, arxiv:2410.11042

January 2025 K. Viswanathan, Y. Gardinazzi, G. Panerai, A. Cazzaniga, **M. Biagetti**, “*The Geometry of Tokens in Internal Representations of Large Language Models*”, arxiv:2501.10573

Mar 2024 J.H.T. Yip, **M. Biagetti**, A. Cole, K. Viswanathan, G. Shiu “*Cosmology with Persistent Homology: a Fisher Forecast*”, JCAP 09 (2024) 034, arxiv:2403.13985

Dec 2023 Euclid Collaboration “*Euclid preparation. XLI. Galaxy power spectrum modelling in real space*”, Astronom. Astrophys. 687 (2024) A216, arxiv:2312.00670

Nov 2023 G. Gambardella, **M. Biagetti**, C. Moretti, E. Sefusatti “*On the range of validity of perturbative models for galaxy clustering and its uncertainty*”, Phys. Rev. D 110 (2024) 8, 083502, arxiv:2311.04608

Dec 2022 **M. Biagetti**, J. Calles, L. Castiblanco, K. Gonzalez, J. Noreña “*A Model for the Squeezed Bispectrum in the Non-Linear Regime*”, arxiv:2212.11940

- Nov 2022 Euclid collaboration (J. Adamek, R. Angulo, C. Arnold, M. Baldi, M. Biagetti et al.) “*Euclid: modeling massive neutrinos in cosmology – a code comparison*”, JCAP 06 (2023) 035, arxiv:2211.12457
- Oct 2022 **M. Biagetti**, G. Franciolini, A. Riotto “*The JWST High Redshift Observations and Primordial non-Gaussianity*”, Astrophys.J. 944 (2023) 2, 113 , arxiv:2210.04812
- Jun 2022 *T. Floss, M. Biagetti*, D. Meerburg “*Primordial non-Gaussianity and non-Gaussian Covariance*”, Phys.Rev.D 107 (2023) 2, 023528, arxiv:2206.10458
- Jun 2022 A. Fumagalli, **M. Biagetti**, A. Saro, E. Sefusatti, A. Slosar, P. Monaco, A. Veropalumbo “*Fitting covariance matrices to simulations*”, JCAP 12 (2022) 022, arxiv:2206.05191
- Mar 2022 Snowmass 2022 (A. Achucarro, M. Biagetti et al.) “*Inflation: Theory and Observations*”, arxiv:2203.08128
- Mar 2022 **M. Biagetti**, J. Calles, L. Castiblanco, A. Cole, J. Noreña “*Fisher Forecasts for Primordial non-Gaussianity from Persistent Homology*”, JCAP 10 (2022) 002, arxiv:2203.08262
- Mar 2022 K. Pardede, F. Rizzo, M. Biagetti, E. Castorina, E. Sefusatti, P. Monaco “*Bispectrum-window convolution via Hankel transform*”, JCAP 10 (2022) 066, arxiv:2203.04174
- Nov 2021 **M. Biagetti**, L. Castiblanco, J. Noreña, E. Sefusatti “*The Covariance of Squeezed Bispectrum Configurations*”, JCAP 09 (2022) 009, arxiv:2111.05887
- Jul 2021 D. Alkhanishvili, C. Porciani, E. Sefusatti, M. Biagetti, A. Lazanu, A. Oddo, V. Yankelevich “*The reach of next-to-leading-order perturbation theory for the matter bispectrum*”, MNRAS 512 (2022) 4, arxiv:2107.08054
- May 2021 M. Biagetti, V. De Luca, G. Franciolini, A. Kehagias, A. Riotto “*The Formation Probability of Primordial Black Holes*”, PLB 820 (2021) 136602, arxiv:2105.07810
- Dec 2020 A. Cole, M. Biagetti, G. Shiu “*Topological Echoes of Primordial Physics in the Universe at Large Scales*”, NeurIPS 2020, arxiv:2012.03616
- Oct 2020 A. Moradinezhad Dizgah, M. Biagetti, E. Sefusatti, V. Desjacques, J. Noreña, “*Primordial Non-Gaussianity from Biased Tracers: Likelihood Analysis of Real-Space Power Spectrum and Bispectrum*”, JCAP 05 (2021) 015, arxiv:2010.14523
- Sep 2020 **M. Biagetti**, A. Cole, G. Shiu, “*The Persistence of Large Scale Structures I: Primordial non-Gaussianity*”, JCAP 04 (2021) 061, arXiv:2009.04819
- Jan 2020 **M. Biagetti**, G. Orlando, “*Primordial Gravitational Waves from Galaxy Intrinsic Alignments*”, JCAP 07 (2020) 005, arXiv:2001.05930
- Sep 2019 K. C. Chan, Y. Li, M. Biagetti, N. Hamaus, “*Measurement of Void Bias Using Separate Universe Simulations*”, ApJ 2, 889 (2020), arXiv:1909.03736
- Jun 2019 **M. Biagetti**, “*The Hunt for Primordial Interactions in the Large Scale Structures of the Universe*”, Galaxies 7, 3 (2019), arXiv:1906.12244
- Jun 2019 F. Beutler, **M. Biagetti**, D. Green, A. Slosar, B. Wallisch, “*Primordial Features from Linear to Nonlinear Scales*”, PRR 1 ,3, 033209 (2019), arXiv:1906.08758
- Dec 2018 K. C. Chan, N. Hamaus, M. Biagetti, “*Constraint of Void Bias on Primordial non-Gaussianity*”, PRD D99, 121304 (2019), arXiv:1812:04024

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- Apr 2018 **M. Biagetti**, G. Franciolini, A. Kehagias, A. Riotto, “*Primordial Black Holes from Inflation and Quantum Diffusion*”, JCAP 1807, 032 (2018), arXiv:1804.07124
- Apr 2018 A. Nusser, M. Biagetti, V. Desjacques, “*Abundance of peaks and dips in three-dimensional mass and halo density fields: a test for cosmology*”, MNRAS 480, 1599 (2018), arXiv:1804.05328
- Aug 2017 **M. Biagetti**, M. Fasiello, E. Dimastrogiovanni, “*Possible Signatures of the Inflationary Particle Content: Spin-2 fields*”, JCAP 1710, 038 (2017), arXiv:1708.01587
- Nov 2016 **M. Biagetti**, T. Lazeyras, T. Baldauf, V. Desjacques, F. Schmidt, “*Verifying the consistency relation for the scale-dependent bias from local primordial non-Gaussianity*”, MNRAS 468, 3 (2017), arXiv:1611.04901
- Dec 2015 A. Moradinezhad, K. C. Chan, J. Noreña, M. Biagetti, V. Desjacques, “*Squeezing the halo bispectrum: a test of bias models*”, JCAP 1609, 030 (2016), arXiv:1512.06084
- Aug 2015 **M. Biagetti**, A. Kehagias, D. Racco, A. Riotto, “*The Halo Boltzmann Equation*”, JCAP 1604, 040 (2016), arXiv:1508.07330
- Feb 2015 **M. Biagetti**, A. Kehagias, A. Riotto, “*What can we learn from the running of the spectral index if no tensors are detected in the cosmic microwave background anisotropy*”, PRD D91 103527 (2015), arXiv:1502.02289
- Jan 2015 **M. Biagetti**, V. Desjacques, “*Scale-dependent bias from an inflationary bispectrum: the effect of a stochastic moving barrier*”, MNRAS 451 no.4, 3643-3648 (2015), arXiv:1501.04982
- Nov 2014 **M. Biagetti**, M. Fasiello, E. Dimastrogiovanni, M. Peloso, “*Gravitational Waves and Scalar Perturbations from Spectator Fields*”, JCAP 1504, 011 (2015), arXiv:1411.3029
- Aug 2014 **M. Biagetti**, V. Desjacques, A. Kehagias, A. Riotto, “*Halo Velocity Bias*”, PRD D90 103529 (2014), arXiv:1408.0293
- Jun 2014 V. Desjacques, A. Moradinezhad, M. Biagetti, “*Ultraviolet background fluctuations with clustered sources*”, MNRAS 444 no.3, 2793-2807 (2014), arXiv:1406.6379
- May 2014 **M. Biagetti**, V. Desjacques, A. Kehagias and A. Riotto, “*Nonlocal halo bias with and without massive neutrinos*”, PRD D90, 045022 (2014), arXiv:1405.1435
- Oct 2013 **M. Biagetti**, K. C. Chan, V. Desjacques, A. Paranjape, “*Measuring nonlocal Lagrangian peak bias*”, MNRAS 441 no.2, 1457-1467 (2014), arXiv:1310.1401
- May 2013 **M. Biagetti**, M. Fasiello, A. Riotto, “*Enhancing Inflationary Tensor Modes Through Spectator Fields*”, PRD D88 103518 (2013), arXiv:1305.7241
- Apr 2013 M. Biagetti, A. Kehagias, E. Morgante, H. Perrier, A. Riotto, “*Symmetries of vector perturbations during DeSitter epoch*”, JCAP 1307, 030 (2013), arXiv: 1304.7785
- Jan 2013 **M. Biagetti**, H. Perrier, A. Riotto, V. Desjacques, “*Testing the running of non-Gaussianity through the CMB mu-distorsion and the halo bias*”, PRD D87 063521 (2013), arXiv:1301.2771
- Aug 2012 **M. Biagetti**, V. Desjacques, A. Riotto, “*Testing Multi-Field Inflation with Galaxy Bias*”, MNRAS 1774-1780 (2013), arXiv:1208.1616