

Luca Marchetti

Curriculum Vitæ

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Research objective and interests

*Extraction of continuum physics from quantum gravity theories
and its possible comparison with observations.*

More precisely, I am interested in the following research directions:

- ▷ Classical and quantum cosmology;
- ▷ Black hole physics and spacetime thermodynamics;
- ▷ Quantum gravity phenomenology;
- ▷ Relational physics and the problem of time;
- ▷ Mathematical and foundational aspects of quantum gravity theories.

Employment

2023-2025 **Postdoctoral Fellowship**, *Department of Mathematics and Statistics, UNB Fredericton.*
(Co-funded by AARMS.)

2022 **Postdoctoral Fellowship**, *Arnold Sommerfeld Center, LMU Munich.*
(Funded by Fondazione Angelo della Riccia grant.)

Education

2018 - 2022 **Cotutelle Ph.D. in Physics**, *University of Pisa – LMU Munich, (Cum Laude).*

Finishing date: 31/01/2022.

Date of defense: 05/07/2022.

Thesis title: “Emergent Continuum Physics from Quantum Gravity”.

Supervisors: Dr. G. Cella (INFN Pisa), Dr. D. Oriti (ASC, LMU Munich).

Thesis Referees: Prof. Mairi Sakellariadou (King’s College), Prof. Roberto Percacci (Sissa).

Examiners: Dr. Dario Benedetti (École polytechnique, CPHT), Prof. Salvatore Capozziello (University of Naples).

2015 - 2018 **Master’s Degree in Theoretical Physics**, *University of Pisa, (110L/110).*

Thesis title: “Using correlations to experimentally search for quantum gravity effects”.

Supervisor: Dr. G. Cella (INFN Pisa).

2012 - 2015 **Bachelor’s Degree in Physics**, *University of Pisa, (110L/110).*

Thesis title: “Quantum Mechanics in curved spaces”.

Supervisors: Prof. K. Konishi (University of Pisa).

List of publications

- [1] Luca Alexander F. Jercher Marchetti and Andreas G. A. *Scalar Cosmological Perturbations from Quantum Entanglement within Lorentzian Quantum Gravity*. Aug. 2023. arXiv: [2308.13261 \[gr-qc\]](#).
- [2] Luca Marchetti, Daniele Oriti, Andreas G. A. Pithis, and Johannes Thürigen. "Mean-Field Phase Transitions in Tensorial Group Field Theory Quantum Gravity". In: *Phys. Rev. Lett.* 130.14 (2023), p. 141501. DOI: [10.1103/PhysRevLett.130.141501](#). arXiv: [2211.12768 \[gr-qc\]](#).
- [3] Luca Marchetti, Daniele Oriti, Andreas G. A. Pithis, and Johannes Thürigen. "Phase transitions in TGFT: a Landau-Ginzburg analysis of Lorentzian quantum geometric models". In: *JHEP* 02 (2023), p. 074. DOI: [10.1007/JHEP02\(2023\)074](#). arXiv: [2209.04297 \[gr-qc\]](#).
- [4] Luca Marchetti and Daniele Oriti. "Effective dynamics of scalar cosmological perturbations from quantum gravity". In: *JCAP* 07.07 (2022), p. 004. DOI: [10.1088/1475-7516/2022/07/004](#). arXiv: [2112.12677 \[gr-qc\]](#).
- [5] Luca Marchetti, Daniele Oriti, Andreas G. A. Pithis, and Johannes Thürigen. "Phase transitions in tensorial group field theories: Landau-Ginzburg analysis of models with both local and non-local degrees of freedom". In: *JHEP* 21 (2021), p. 201. DOI: [10.1007/JHEP12\(2021\)201](#). arXiv: [2110.15336 \[gr-qc\]](#).
- [6] Luca Marchetti and Giancarlo Cella. *Impact of a modified Entropy-Area law on Schwarzschild-de Sitter metric*. Oct. 2021. arXiv: [2110.15325 \[gr-qc\]](#).
- [7] Steffen Gielen, Luca Marchetti, Daniele Oriti, and Axel Polaczek. "Effective cosmology from one-body operators in group field theory". In: *Classical and Quantum Gravity* (Jan. 2022). arXiv: [2110.11176 \[gr-qc\]](#). URL: <http://iopscience.iop.org/article/10.1088/1361-6382/ac5052>.
- [8] Luca Marchetti and Daniele Oriti. "Quantum fluctuations in the effective relational GFT cosmology". In: *Front. Astron. Space Sci.* 8 (2021), p. 683649. DOI: [10.3389/fspas.2021.683649](#). arXiv: [2010.09700 \[gr-qc\]](#).
- [9] Luca Marchetti and Daniele Oriti. "Effective relational cosmological dynamics from Quantum Gravity". In: *JHEP* 05 (2021), p. 025. DOI: [10.1007/JHEP05\(2021\)025](#). arXiv: [2008.02774 \[gr-qc\]](#).

Grants and awards

- 2022 **AARMS Postdoctoral Fellowship**, CAD 53,000.
- 2021 **Fondazione Angelo della Riccia Grant**, *Cosmological perturbation theory from Quantum Gravity*, PI, €17,700.

Public presentations

Conferences and Workshops

- Sep. 2023 IFT Madrid (Spain), *COSMO '23*, title of the talk: "Emergent cosmology from Quantum Gravity"
- Sep. 2023 LMU Munich (Germany), *GFT Cosmology Workshop*, title of the talk: "Relational physics in Group Field Theories"
- July 2023 Radboud University Nijmegen (The Netherlands), *Quantum Gravity 2023*, title of the talk: "Scalar cosmological perturbations from full quantum gravity"
- June 2023 UNB Fredericton (Canada), *CAP Congress*, title of the talk "Emergent Cosmology from Quantum Gravity".
- June 2023 Mount Allison University (Canada), *Theory Canada 15*, title of the talk "Scalar cosmological perturbations from full quantum gravity".
- Mar. 2023 LMU Munich (Germany), *Foundations of Observational, Classical and Semi-Classical Gravitational Physics and The Problem of Agency and Laws of Nature*, title of the talk "Emergent Cosmological Physics from Quantum Gravity".
- Dec. 2022 LMU Munich (Germany), *Quantum gravity, Hydrodynamics and Emergent Cosmology*, title of the talk "Emergent Cosmology from (T)GFT Condensates".
- July 2022 ENS Lyon (France), *LOOPS '22*, title of the talk: "Cosmological inhomogeneities and relational perturbations of quantum gravity condensates".

June 2021 Perimeter Institute (Canada), *Quantizing time*, title of the talk: “Relational dynamics in an emergent spacetime context”.

Seminars

Apr. 2023 FAU Erlangen-Nürnberg (Germany), *Quantum Gravity group seminar*.
Apr. 2023 Online, *ILQGS*.
Feb. 2023 UNB Fredericton (Canada), *Gravity group seminars*.
Sep. 2022 OIST Okinawa (Japan), *QUAST group seminar*.
Sep. 2022 OIST Okinawa (Japan), *Quantum Geometry and Field Theory group seminar*.
June 2022 LMU Munich (Germany), *Quantum Gravity group seminar*.
Nov. 2021 LMU Munich (Germany), *Quantum Gravity group seminar*.
Nov. 2021 UNB Fredericton (Canada), *Gravity group seminar*.
Apr. 2021 LMU Munich (Germany), *Quantum Gravity group seminar*.
Feb. 2021 LMU Munich (Germany), *Quantum Gravity group seminar*.
Sep. 2020 University of Pisa (Italy), *Ph.D. seminars*.
July 2020 LMU Munich (Germany), *Fields and strings seminar*.
June 2020 LMU Munich (Germany), *Quantum Gravity group seminar*.
Sep. 2019 University of Pisa (Italy), *Ph.D. seminars*.
Feb. 2018 INFN Pisa (Italy), *Virgo Pisa data analysis group meeting*.
Nov. 2017 University of Pisa (Italy), *Comparative Quantum Gravity group seminar*.

Organizational/Institutional roles and mentoring

Organizational roles

Dec. 2022 Organizer of the workshop Quantum gravity, Hydrodynamics and Emergent Cosmology (LMU Munich).

Institutional roles

June 2022 Member of the COST action CA18108 - Quantum gravity phenomenology in the multi-messenger approach (QG-MM).
Sep. 2021 Member of the International Society for Quantum Gravity; 🌐 isqg.org.
Jan. 2018 Founder of CQG group; 🌐 comparativequantumgravity.wordpress.com.

Mentoring

2021-today Co-supervising Master student David Garcia at LMU Munich;
2021-2022 Co-supervising Master student Patrick Fisher at LMU Munich;
2021-2022 Co-supervising Master student Tom Ladstätter at LMU Munich;

Conferences, workshops and seminar series attended

The symbol (🗨) indicates that I gave a talk (see above) at the corresponding event.

Conferences and workshops

Mar. 2023 **Foundations of Observational, Classical and Semi-Classical Gravitational Physics and The Problem of Agency and Laws of Nature** (🗨), *LMU Munich*.
Feb. 2022 **Time and Clocks**, *Physikzentrum Bad-Honnef*.
Dec. 2022 **Quantum gravity, Hydrodynamics and Emergent Cosmology** (🗨), *LMU Munich*.
July 2022 **LOOPS '22** (🗨), *ENS de Lyon*.
June 2022 **The Quantum, the Thermal and the Gravitational Reconciled**, *Munich*.
Feb. 2022 **9th Tux Workshop on Quantum Gravity**, *Tux, online*.
Oct. 2021 **First International Society for Quantum Gravity workshop**, *Online*.
Sept. 2021 **Black holes inside and out**, *Online*.

- June 2021 **Quantizing time** (📍), *Perimeter Institute, online.*
- June 2020 **QG meets dark energy**, *Online.*
- Apr. 2020 **Phenomenology of Quantum Gravity**, *Online.*
- Oct. 2019 **Quantum gases, fundamental interactions and cosmology**, *Pisa.*

Seminar series

- 2020-today **Quantum Gravity across approaches**, *Online.*
- 2020-today **Non-local Quantum Gravity seminars**, *Lyon, online.*
- 2020-today **Quantum Gravity group seminars** (📍), *Munich, online.*
- 2020-today **Fields and strings seminars** (📍), *Munich, online.*
- 2020-today **Black hole thermodynamics and semiclassical gravity collaboration seminars** (📍), *Online.*

Academic and professional development

- June 2021 **LQG Summer School**, *Online.*
Fundamentals: Loop quantum gravity, spin network and spinfoams; black holes: classical and quantum theory; Group Field Theories and random geometries; QFT on curved spacetime and applications; quantum information for quantum gravity; symmetries and conserved charges in General Relativity.
Advanced topics: Black hole to white hole transition; numerical methods in loop quantum gravity; effective spinfoam and renormalization; quantum gravity experiments; gravitational waves and prospects for quantum gravity; the infrared triangle in quantum gravity.
- July 2021 **Percorso Formativo 24 CFU**, *Università di Pisa.*
 I passed the four exams (anthropology, psychology, pedagogy and educational methods and technologies) necessary in order to teach in Italy.
- Apr. 2019 **School on Astroparticle Physics, Gravitation and Cosmology**, *GGI, Arcetri.*
 Topics covered: Cosmological perturbation theory and structure formation; Gravitational waves and compact binaries; Neutrino physics; Galactic CRs and multimessenger astronomy.

“Introduction to Physical Cosmology”

- 2018-today Together with M. Monelli (MPA, Garching) and Prof. A. Ferrara (SNS, Pisa), I drafted a book on physical cosmology soon to be published by Edizioni della Normale; 🌐 front matter and book description available at http://cosmology.sns.it/physical_cosmology_book.html.

Technical skills

Latex: Mathematica: Python:

Public engagement

- May 2019 Speaker at *Pint of Science* event in Pisa titled “Black Holes: a window on Quantum Gravity”.