Matteo Tagliazucchi

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18 April 1998
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iNSPIRE profile
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Summary. PhD candidate in Physics at the University of Bologna. Working on developing advanced statistical and computational methods for gravitational wave cosmology, particularly using standard sirens, and on gravitational wave data analysis. Experienced in Bayesian inference, high-performance and GPU computing. Actively contributing to collaborative research within the LIGO-Virgo-KAGRA and Einstein Telescope collaborations.

Positions

01/03/23–currently — **Ph.D. student** in Physics at the University of Bologna.

01/09/24 – 01/03/2025 — **Visiting student** at the Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam - Germany. Working with Dr. Jonathan Gair.

Education

01/03/23 – · · · — **Ph.D. in Physics, University of Bologna.**
Research topic: *Optimal methods for GW exploitation in the context of current and future Gravitational Waves Observatories.*
Supervisor: *Prof. Michele Moresco..*
Co-supervisor: *Prof. Daniele Bonacorsi.*
Position funded by the ICSC – National Centre for HPC, Big Data and Quantum Computing (HPC CN00000013 – CUP J33C22001170001).

21/09/20 – 24/02/23 — **M.Sc. Physics, University of Bologna** - curriculum in theoretical physics.
Thesis title: *Spectral distortions of the cosmic microwave background and small-scale gravitational waves as new windows on the Early Universe.*
Supervisor: *Prof. Roberto Balbinot.*
Co-supervisors: *Dr. Fabio Finelli, Dr. Matteo Braglia, Dr. Daniela Paoletti*
Final grade: *110/110 with distinction* (weighted average of exam mark: 29.75/30).
Thesis project developed during a 6-month **internship** at INAF-OAS, Bologna.

25/09/17 – 24/07/20 — **B.Sc. Physics, University of Bologna.**
Thesis title: *Renormalization in non-relativistic quantum-mechanics.*
Supervisor: *Prof. Fabio Maltoni.*
Final grade: *110/110 with distinction* (weighted average of exam mark: 29.33/30).

Advanced training

17/04/24 – 19/04/2024 — **Introduction to HPC, parallel computing and Machine Learning**, CINECA, Caselecchio di Reno (BO) - Italy.

28/02/24 – 01/03/24 — **Julia High Performance**, CINECA, Caselecchio di Reno (BO) - Italy.

15/05/23 – 18/05/23 — **Gravitational Wave Open Data Workshop**, online.

08/05/23 – 12/08/23 — **Ph.D. school @ XIII ET Symposium**, Cagliari - Italy.

Presentations

Invited talks at conferences

1. *Combining galaxy catalogs and gravitational wave data to infer cosmological parameters*.
   17th Marcel Grossmann Meeting, 8-12 July 2024, University 'Gabriele d'Annunzio' and ICRANet - Pescara, Italy.

Contributed talks at conferences

1. *Improving Dark Siren Cosmology with a Non-Parametric Completeness Correction*.
   "Shedding Light on Dark Sirens" workshop @ Lorentz center, 22-26 September 2025, Leiden, Netherlands.

2. *Accelerating the Galaxy Catalog Method: Improved Constraints on Cosmology and Modified Gravitational Wave Propagation with Standard Sirens*.
   GR24 & Amaldi16 Meeting, 14-18 July 2025, Glasgow

3. *Advancing dark siren cosmology with GPU-accelerated pipelines and non-parametric methods*
   Virgo Week, 16-20 Jube 2025, EGO/Virgo - Cascina (PI), Italy

4. *Hierarchical inference of cosmological and astrophysical population properties from gravitational wave observations and galaxy catalogs*.
   17th Marcel Grossmann Meeting, 8-12 July 2024, University 'Gabriele d'Annunzio' and ICRANet - Pescara, Italy.

5. *Hierarchical inference of cosmological and population parameters from gravitational wave data with and without electromagnetic counterparts*.
   11th LISA Cosmology Working Group Workshop, 17-21 June 2024, Universidade do Porto - Porto, Portugal.

6. *Inference of cosmological and astrophysical population properties from gravitational wave observations with and without electromagnetic counterparts*.
   ICSC-Spoke2 Annual Meeting, 20 December 2023, CINECA - Caseleccho di Reno (BO), Italy

7. *Combining dark and spectral sirens to infer cosmological parameters from gravitational waves data*.
   IX Meeting on Fundamental Cosmology, 22-24 November 2023, IAC - San Cristóbal de La Laguna (Tenerife), Spain.

Talks at seminars

1. *The quest of CMB spectral distortions to probe the scalar-induced gravitational wave background interpretation in PTA data*.
   Astrophysics Talk at INAF-OAS/DIFA, 31 October 2023, Bologna, Italy.

LVK internal presentations

1. *Pushing spectral sirens into the next-generation era: a blinded mock data challenge*.
   LVK Cosmology WG call, 29 January 2026

2. *Improving GWTC-4.0 spectral siren cosmological constraints using semiparametric mass models*.
   LVK Cosmology WG call, 12 December 2025

3. *Accelerating the Standard Siren Method:* `CHIMERA 2.0`.
   LVK Cosmology WG call, 11 April 2025

Posters

1. *Unlocking Next-Generation Dark Siren Cosmology and General Relativity Tests with CHIMERA 2.0.*
   XV ET Symposium, 26-30 May 2025, Bologna, Italy.

Attendance at conferences and workshops

1. "Shedding Light on Dark Sirens" workshop @ Lorentz center, 22-26 September 2025, Leiden, Netherlands.

2. XV ET Symposium, 26-30 May 2025, Bologna, Italy.

3. XIII ET Symposium, 8-12 May 2023, Cagliari, Italy.

Research publications

1. **M. Tagliazucchi**, M. Moresco, N. Borghi, and C. Ciapetti, "Mind the peak: improving cosmological constraints from GWTC-4.0 spectral sirens using semiparametric mass models," Jan. 2026. arXiv: 2601.03347 [astro-ph.CO].
2. N. Borghi, M. Moresco, **M. Tagliazucchi**, and G. Cuomo, "Echoes from the dark: Galaxy catalog incompleteness in standard siren cosmology," Sep. 2025. arXiv: 2509.18243 [astro-ph.CO].
3. **M. Tagliazucchi**, M. Moresco, N. Borghi, and M. Fiebig, "Accelerating the standard siren method: Improved constraints on modified gravitational-wave propagation with future data," *Astron. Astrophys.*, vol. 702, A244, 2025. DOI: 10.1051/0004-6361/202554827. arXiv: 2504.02034 [astro-ph.CO].
4. E. Di Valentino and others (incl. **M. Tagliazucchi**), "The CosmoVerse White Paper: Addressing observational tensions in cosmology with systematics and fundamental physics," *Phys. Dark Univ.*, vol. 49, p. 101 965, 2025. DOI: 10.1016/j.dark.2025.101965. arXiv: 2504.01669 [astro-ph.CO].
5. A. Abac and others (incl. **M. Tagliazucchi**), "The Science of the Einstein Telescope," Mar. 2025. arXiv: 2503.12263 [gr-qc].
6. N. Borghi, M. Mancarella, M. Moresco, **M. Tagliazucchi**, F. Iacovelli, A. Cimatti, and M. Maggiore, "Cosmology and Astrophysics with Standard Sirens and Galaxy Catalogs in View of Future Gravitational Wave Observations," *Astrophys. J.*, vol. 964, no. 2, p. 191, 2024. DOI: 10.3847/1538-4357/ad20eb. arXiv: 2312.05302 [astro-ph.CO].
7. **M. Tagliazucchi**, M. Braglia, F. Finelli, and M. Pieroni, "Quest for CMB spectral distortions to probe the scalar-induced gravitational wave background interpretation of pulsar timing array data," *Phys. Rev. D*, vol. 111, no. 2, p. L021305, 2025. DOI: 10.1103/PhysRevD.111.L021305. arXiv: 2310.08527 [astro-ph.CO].

Tutoring

Master thesis co-supervision

1. Chiara Ciapetti, *ongoing, finishing in March 2026*; MSc in Astrophysics and Cosmology @ UNIBO (2026)
2. Luca Morelli, Dissipation of primordial gravitational waves into CMB spectral distortions: theory and observation prospects; MSc in Physics (theoretical curriculum) @ UNIBO (2025)
3. Martina Mori, Who Speaks Louder? Optimizing the Extraction of Information from Gravitational Waves for future Cosmological Analyses; MSc in Astrophysics and Cosmology @ UNIBO (2025)
4. Giulia Cuomo, Cosmological Constraints with Standard Sirens: Tackling Galaxy Catalog Incompleteness in Current Gravitational Wave Analysis; MSc in Astrophysics and Cosmology @ UNIBO (2025)
5. Manfred Fiebig, Probing modified Gravitational Wave propagation using Standard Sirens with future observational data; MSc in Astrophysics and Cosmology @ UNIBO (2024)
6. Niccolò Passaleva, Enhancing the potential of gravitational waves as standard sirens: a statistical analysis; MSc in Astrophysics and Cosmology @ UNIBO (2024)

Student tutor

1. November 2021 - December 2022: Physics degree program tutor at University of Bologna
2. September 2020 - December 2020: technical support for teaching in hybrid mode at University of Bologna

Grants and Awards

Grants

1. Young Researcher and Innovator Conference grant. Awarded by the CosmoVerse COST Action CA21136 (2025) for the participation to GR24 & Amaldi16 meeting. Value: €2500
2. Marco Polo grant. Awarded by the University of Bologna (2024-2025) for funding the visiting period at the Max Planck Institute for Gravitational Physics. Value: €2839.26

Computational resources awarded

1. **PI** of **CNHPC_1478660**. Awarded 100 k GPU hours and 200 k CPU hours at the EuroHPC supercomputer LEONARDO, hosted by CINECA (Italy).
2. **PI** of **IsCdo_GPGW**. Awarded 48 k GPU hours at the EuroHPC supercomputer LEONARDO, hosted by CINECA (Italy).

Scientific collaborations

Affiliations

1. 17/04/2025–currently: member of Virgo and of the LIGO-Virgo-KAGRA collaboration
2. 11/01/2024–currently: member of the Einstein Telescope collaboration
3. June 2025 –currently: member of the LISA consortium

Services

1. March-May 2025: member of the Local Organizing Committee of the XV Einstein Telescope Symposium

Other activitites

2018 – present	**Referee** for the Italian National Federation of Tennis and Paddle.
07/10/22 – 28/10/22	**Substitute math and physics teacher** at high school I.I.S. Cavazzi, Via Matteotti 2/4, I-41026 Pavullo nel Frignano (MO) - Italy.

Skills

Languages	Italian (native), English (B2).
Coding	`Python`, `JAX`, `Julia`, `C/C++`
Other scientific tools	LaTeX, `slurm`, Cloud and HPC computing, `git`, `CUDA` programming with `Numba/CuPy`, Linux/Unix OS, OpenOffice, MS Office.
Open source codes	CHIMERA; KDEXPRESS