Lorenzo Speri | Curriculum Vitæ

lorenzo.speri@esa.int • https://lorenzsp.github.io/ • January 7, 2025

Gravitational wave astronomer, developing models of gravitational wave signals and statistical techniques to extract information from observations. Applications include Bayesian and frequentist inference and signal detection for space-borne gravitational wave detectors and pulsar timing array experiments, implementation and speed up of gravitational wave models.

Contacts

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Nationality: Italy

Website & publications record: https://lorenzsp.github.io/ – arXiv – ORCID

Academic positions

European Space Agency **Noordwijk, the Netherlands**

Postdoctoral Research Fellow, European Space Technology Centre *2024 - current*

- *Main activity*: development of LISA data analysis ground-segment for the European Space Agency.

Education

Max Planck Institute for Gravitational Physics (Albert Einstein Institute Potsdam) **Potsdam, Germany**

Ph.D. *2020-2024*

- *Supervisor*: J. Gair.
- *Thesis Title*: Advancing Gravitational Wave Astronomy: Novel Methodologies for Data Analysis and Waveform Modelling of Nanohertz and Millihertz Signals
- *Final Grade*: Summa cum laude

University of Heidelberg **Heidelberg, Germany**

Master's degree in Theoretical physics *2018-2020*

- *Final degree grade*: 1.0 ()
- *Supervisor*: J. Gair and M. Bartelmann. Thesis resulted in one short-author publications.
- *Thesis title*: Effective Resonance Model: a small step for the constants of motion, a giant leap for biases in EMRI parameter estimation.

Università degli Studi di Trento **Trento, Italy**

Bachelor's degree in Physics *2015-2018*

- *Final degree grade*: 110/110.
- *Thesis title*: Analyzing Gravitational Waves through Numerical Simulations of Compact Binaries.

Metrics

Publications:

29 short-author papers published in major peer-reviewed journals (out of which **7** first-authored papers).

11 papers in submission stage,

Total number of citations: >3600. **h-index**: 23 (using ADS and iNSPIRE).

Web links to list services: ADS; iNSPIRE; arXiv; orcid.

Full list of publications available below.

Full list of presentations available below.

Fellowships, Prizes, & Awards

- European Space Agency Postdoctoral Fellowship. *2024*
- Burke Institute Prize Fellowship, Caltech (declined). *2024*
- NASA Postdoctoral Program Fellowship (declined). *2024*
- Merit Award, University of Trento . *2019*
- Erasmus+ Programme Scholarship, University of Oslo . *2023*

Teaching and Public Outreach

- Teaching assistant of Prof. Dr. Alessandra Buonanno for the course of Gravitational Waves *2021*
- Potsdamer Tag der Wissenschaften, Potsdam University. Public Outreach in German. *2021*

I play piano and I love listening to classical music. I like skiing and windsurfing.

Journal referee

- Physical Review D

Conference organizer (or committee member)

- *1st Trieste meeting on the physics of gravitational waves*, Trieste, Italy *2023*

Memberships

- LISA Consortium, full member. *since 2020*
- EPTA, full member. *since 2020*
- IPTA, full member. *since 2020*

Skills

Programming languages: Python, Bash, Mathematica, C++.

Languages: English (fluent), Italian (native), German (intermediate)

Hobbies

I play piano and I love listening to classical music. I like skiing and windsurfing.

Full publication list

Submitted short-author and collaboration papers which I have substantially contributed to.:

11. *Is your stochastic signal really detectable?*.
Pozzoli, Federico; Gair, Jonathan; Buscicchio, Riccardo; **Speri, Lorenzo**.
10.48550/arXiv.2412.10468.
10. *Searches for signatures of ultra-light axion dark matter in polarimetry data of the European Pulsar Timing Array*.
Porayko, N. K. et al. (include **Speri, L.**).
10.48550/arXiv.2412.02232.
9. *Constraining accretion physics with gravitational waves from eccentric extreme-mass-ratio inspirals*.
Duque, Francisco; Kejriwal, Shubham; Sberna, Laura; **Speri, Lorenzo**; Gair, Jonathan.
10.48550/arXiv.2411.03436.
8. *Impact of relativistic waveforms in LISA's science objectives with extreme-mass-ratio inspirals*.
Khalvati, Hassan; Santini, Alessandro; Duque, Francisco; **Speri, Lorenzo**; Gair, Jonathan; Yang, Huan; Brito, Richard.
10.48550/arXiv.2410.17310.
7. *Fewer supermassive binary black holes in pulsar timing array observations*.
Goncharov, Boris et al. (include **Speri, L.**).
10.48550/arXiv.2409.03627.
6. *Probing fundamental physics with Extreme Mass Ratio Inspirals: a full Bayesian inference for scalar charge*.
Speri, Lorenzo; Barsanti, Susanna; Maselli, Andrea; Sotiriou, Thomas P.; Warburton, Niels; van de Meent, Maarten; Chua, Alvin J. K.; Burke, Ollie; Gair, Jonathan.
10.48550/arXiv.2406.07607.
5. *GWnext 2024: Meeting Summary*.
Torres-Orjuela, Alejandro et al. (include **Speri, L.**).
10.48550/arXiv.2406.03498.
4. *LISA Definition Study Report*.
Colpi, Monica et al. (include **Speri, L.**).
10.48550/arXiv.2402.07571.
3. *Massive black hole binaries in LISA: constraining cosmological parameters at high redshifts*.
Mangiagli, Alberto; Caprini, Chiara; Marsat, Sylvain; **Speri, Lorenzo**; Caldwell, Robert R.; Tamanini, Nicola.
10.48550/arXiv.2312.04632.
2. *Waveform Modelling for the Laser Interferometer Space Antenna*.
LISA Consortium Waveform Working Group et al. (include **Speri, L.**).
10.48550/arXiv.2311.01300.
1. *Fast and Fourier: Extreme Mass Ratio Inspiral Waveforms in the Frequency Domain*.
Speri, Lorenzo; Katz, Michael L.; Chua, Alvin J. K.; Hughes, Scott A.; Warburton, Niels; Thompson, Jonathan E.; Chapman-Bird, Christian E. A.; Gair, Jonathan R.
10.48550/arXiv.2307.12585.

Papers in major peer-reviewed journals:

29. *Systematics in tests of general relativity using LISA massive black hole binaries*.
Garg, Mudit; Sberna, Laura; **Speri, Lorenzo**; Duque, Francisco; Gair, Jonathan.
10.1093/mnras/stae2605. Published in Monthly Notices of the Royal Astronomical Society.
28. *Impact of correlations on the modeling and inference of beyond vacuum–general relativistic effects in extreme-mass-ratio inspirals*.
Kejriwal, Shubham; **Speri, Lorenzo**; Chua, Alvin J. K.
10.1103/PhysRevD.110.084060. Published in Physical Review D.
27. *The second data release from the European Pulsar Timing Array. V. Search for continuous gravitational wave signals*.
EPTA Collaboration et al. (include **Speri, L.**).
10.1051/0004-6361/202348568. Published in Astronomy and Astrophysics.
26. *Assessing the importance of first postadiabatic terms for small-mass-ratio binaries*.
Burke, Ollie; Piovano, Gabriel Andres; Warburton, Niels; Lynch, Philip; **Speri, Lorenzo**; Kavanagh, Chris; Wardell, Barry; Pound, Adam; Durkan, Leanne; Miller, Jeremy.
10.1103/PhysRevD.109.124048. Published in Physical Review D.

25. *Comparing Recent Pulsar Timing Array Results on the Nanohertz Stochastic Gravitational-wave Background*.
Agazie, G. et al. (include **Speri, L.**).
10.3847/1538-4357/ad36be. Published in The Astrophysical Journal.

24. *The second data release from the European Pulsar Timing Array. IV. Implications for massive black holes, dark matter, and the early Universe*.
EPTA Collaboration et al. (include **Speri, L.**).
10.1051/0004-6361/202347433. Published in Astronomy and Astrophysics.

23. *Impact of the noise knowledge uncertainty for the science exploitation of cosmological and astrophysical stochastic gravitational wave background with LISA*.
Muratore, Martina; Gair, Jonathan; **Speri, Lorenzo**.
10.1103/PhysRevD.109.042001. Published in Physical Review D.

22. *Practical approaches to analyzing PTA data: Cosmic strings with six pulsars*.
Quelquejay Leclere, Hippolyte et al. (include **Speri, L.**).
10.1103/PhysRevD.108.123527. Published in Physical Review D.

21. *Cosmology with the Laser Interferometer Space Antenna*.
Auclair, Pierre et al. (include **Speri, L.**).
10.1007/s41114-023-00045-2. Published in Living Reviews in Relativity.

20. *The second data release from the European Pulsar Timing Array. I. The dataset and timing analysis*.
EPTA Collaboration et al. (include **Speri, L.**).
10.1051/0004-6361/202346841. Published in Astronomy and Astrophysics.

19. *The second data release from the European Pulsar Timing Array. II. Customised pulsar noise models for spatially correlated gravitational waves*.
EPTA Collaboration et al. (include **Speri, L.**).
10.1051/0004-6361/202346842. Published in Astronomy and Astrophysics.

18. *The second data release from the European Pulsar Timing Array. III. Search for gravitational wave signals*.
EPTA Collaboration et al. (include **Speri, L.**).
10.1051/0004-6361/202346844. Published in Astronomy and Astrophysics.

17. *Second Data Release from the European Pulsar Timing Array: Challenging the Ultralight Dark Matter Paradigm*.
Smarra, Clemente et al. (include **Speri, L.**).
10.1103/PhysRevLett.131.171001. Published in Physical Review Letters.

16. *BlackHolePerturbationToolkit/FastEMRIWaveforms: Frequency Domain Waveform Added!*.
Katz, Michael L.; **Speri, Lorenzo**; Chua, Alvin J. K.; Chapman-Bird, Christian E. A.; Warburton, Niels; Hughes, Scott A.
10.5281/zenodo.8190418. Published in Zenodo.

15. *Cosmology with massive black hole binary mergers in the LISA era*.
Mangiagli, A.; Caprini, C.; Volonteri, M.; Marsat, S.; Vergani, S.; Tamanini, N.; **Speri, L.**.
Published in 41st International Conference on High Energy Physics.

14. *Searching for continuous Gravitational Waves in the second data release of the International Pulsar Timing Array*.
Falxa, M. et al. (include **Speri, L.**).
10.1093/mnras/stad812. Published in Monthly Notices of the Royal Astronomical Society.

13. *Probing Accretion Physics with Gravitational Waves*.
Speri, Lorenzo; Antonelli, Andrea; Sberna, Laura; Babak, Stanislav; Barausse, Enrico; Gair, Jonathan R.; Katz, Michael L.
10.1103/PhysRevX.13.021035. Published in Physical Review X.

12. *Constraining the evolution of Newton's constant with slow inspirals observed from spaceborne gravitational-wave detectors*.
Barbieri, Riccardo; Savastano, Stefano; **Speri, Lorenzo**; Antonelli, Andrea; Sberna, Laura; Burke, Ollie; Gair, Jonathan; Tamanini, Nicola.
10.1103/PhysRevD.107.064073. Published in Physical Review D.

11. *Quality over quantity: Optimizing pulsar timing array analysis for stochastic and continuous gravitational wave signals*.
Speri, Lorenzo; Porayko, Nataliya K.; Falxa, Mikel; Chen, Siyuan; Gair, Jonathan R.; Sesana, Alberto; Taylor, Stephen R.
10.1093/mnras/stac3237. Published in Monthly Notices of the Royal Astronomical Society.

10. *A roadmap of gravitational wave data analysis*.
Speri, Lorenzo; Karnesis, Nikolaos; Renzini, Arianna I.; Gair, Jonathan R.
10.1038/s41550-022-01849-y. Published in Nature Astronomy.

9. *Modeling transient resonances in extreme-mass-ratio inspirals.*
Gupta, Priti; **Speri, Lorenzo**; Bonga, Beátrice; Chua, Alvin J. K.; Tanaka, Takahiro.
10.1103/PhysRevD.106.104001. Published in Physical Review D.

8. *Assessing the impact of instrumental calibration uncertainty on LISA science.*
Savalle, Etienne; Gair, Jonathan; **Speri, Lorenzo**; Babak, Stanislav.
10.1103/PhysRevD.106.022003. Published in Physical Review D.

7. *Workshop on Gravitational-Wave Astrophysics for Early Career Scientists.*
Bayle, Jean-Baptiste et al. (include **Speri, L.**).
10.1038/s41550-022-01629-8. Published in Nature Astronomy.

6. *The International Pulsar Timing Array second data release: Search for an isotropic gravitational wave background.*
Antoniadis, J. et al. (include **Speri, L.**).
10.1093/mnras/stab3418. Published in Monthly Notices of the Royal Astronomical Society.

5. *Noise analysis in the European Pulsar Timing Array data release 2 and its implications on the gravitational-wave background search.*
Chalumeau, A. et al. (include **Speri, L.**).
10.1093/mnras/stab3283. Published in Monthly Notices of the Royal Astronomical Society.

4. *Common-red-signal analysis with 24-yr high-precision timing of the European Pulsar Timing Array: inferences in the stochastic gravitational-wave background search.*
Chen, S. et al. (include **Speri, L.**).
10.1093/mnras/stab2833. Published in Monthly Notices of the Royal Astronomical Society.

3. *Fast extreme-mass-ratio-inspiral waveforms: New tools for millihertz gravitational-wave data analysis.*
Katz, Michael L.; Chua, Alvin J. K.; **Speri, Lorenzo**; Warburton, Niels; Hughes, Scott A.
10.1103/PhysRevD.104.064047. Published in Physical Review D.

2. *Assessing the impact of transient orbital resonances.*
Speri, Lorenzo; Gair, Jonathan R.
10.1103/PhysRevD.103.124032. Published in Physical Review D.

1. *Testing the quasar Hubble diagram with LISA standard sirens.*
Speri, Lorenzo; Tamanini, Nicola; Caldwell, Robert R.; Gair, Jonathan R.; Wang, Benjamin.
10.1103/PhysRevD.103.083526. Published in Physical Review D.

Full presentation list

Invited talks marked with *.

Talks at conferences:

10.* *LISA data analysis highlight.*
LISA-Netherlands Community Day, Nikhef, Amsterdam, 2024/10.

9. *FastEMRIWaveforms: Waveform package for asymmetric binaries.*
15th LISA Symposium, Dublin, Ireland, 2024/07.

8.* *Challenges and prospects of future Pulsar Timing Array analyses.*
11th LISA Cosmology Working Group Workshop, Porto, Portugal, 2024/06.

7.* *Testing General Relativity with LISA observations.*
Asymmetric Binaries Meet Fundamental Astrophysics, L'Aquila, Italy, 2023/09.

6. *Beyond vacuum Extreme Mass Ratio Inspirals.*
1st Trieste Meeting on the Physics of Gravitational Waves, Trieste, Italy, 2023/06.

5. *Fast EMRI Waveform package: New tools for millihertz gravitational-wave data analysis.*
LISA data analysis workshop: from classical methods to machine learning, Toulouse, France, 2022/11.

4. *Probing accretion disk physics with Extreme Mass Ratio Inspirals.*
25th Capra Meeting on Radiation Reaction in General Relativity, Dublin, Ireland, 2022/06.

3. *Testing General Relativity with Extreme Mass Ratio Inspirals.*
EuCAPT Workshop: Gravitational wave probes of black hole environments, Rome, Italy, 2022/06.

2. *Assessing the impact of transient orbital resonances.*
24th Capra Meeting on Radiation Reaction in General Relativity, Online, 2021/06.

1. *Pulsar selection methods.*
EPTA spring meeting, Online, 2021/03.

Talks at department seminars:

5.* *Challenges of LISA Data Analysis.*
Institute for Gravitational and Subatomic Physics (GRASP), Utrecht, 2024/12.

4.* *Gravitational Wave Observations in the Millihertz Regime: Prospects and Challenges of the Upcoming LISA Mission.*
GRAPPA Colloquium, Amsterdam, 2024/11.

3.* *With great precision comes great challenges: Gravitational Wave Observations of Extreme Mass Ratio Inspirals.*
TAPIR Seminar, Caltech, Pasadena, 2023/12.

2.* *Probing Accretion Physics with Gravitational Waves.*
OzGrav Seminar, online, 2023/08.

1.* *Extreme Mass Ratio Inspiral Waveforms in a nutshell.*
University of Amsterdam, Amsterdam, Netherlands, 2023/01.
- Two tutorial sessions of 2 hours each.