Rossella Gamba

N3AS Fellow, UC Berkeley
rgamba@berkeley.edu | github.com/RoxGamba

Principal Interests

Gravitational Wave (GW) Astronomy and Data Analysis, Effective-One-Body (EOB) waveform models, Binary Neutron Stars (BNS), Dense matter and NS Equation of State (EoS).

Experience

N3AS Fellow Nov. 2023 – current
UC Berkeley *Berkeley, CA, USA*

- Fellowship in the NSF-funded N3AS (Network for Neutrinos, Nuclear Astrophysics, and Symmetries) program
- Research on the development of waveform models for GWs from BBH and BNS mergers

Long term visitor Nov. 2023 – current
Penn State University *State College, PA, USA*

- Collaboration with members of the Institute for Gravitation and the Cosmos (IGC)

Education

Ph.D. in Theoretical Physics Nov 2019 - Sept 2023
Friedrich-Schiller-Universität Jena *Jena, Germany*

- Advisor: Prof. Dr. S. Bernuzzi
- Thesis: "Fast and faithful Effective One Body models for gravitational waves from generic compact binaries", Summa cum laude, awarded with the "Rhode-Schwartz faculty prize"

M.Sc. in Physics Oct 2017 - Oct 2019
Università di Torino *Torino, Italy*

- Advisors: Dr. A. Nagar, Prof. Dr. J. S. Read
- Thesis: "Systematics in gravitational-wave binary neutron stars data analysis", 110/110 cum laude

B.Sc. in Physics Oct 2015 - Oct 2017
Università di Torino *Torino, Italy*

- Advisors: Prof. Dr. Giovanni Trinchero, Prof. Dr. Jan Conrad
- Thesis: "On the asymptotic behaviour of likelihood ratio test statistics", 110/110 cum laude

Teaching

Advanced Quantum Mechanics tutorials 2020 – 2023
Friedrich-Schiller-Universität Jena *Jena, Germany*

- Tutorials for the graduate-level Advanced Quantum Mechanics class held by Prof. Dr. Sebastiano Bernuzzi.

Tutor for Projektpraktikum 2020 – 2022
Friedrich-Schiller-Universität Jena *Jena, Germany*

- Tutor for the computational "Projektpraktikum" class on numerical solutions of the one-dimensional wave equation.

Student supervision and co-supervision

6. Danilo Chiaramello, *Tidally torquing a black hole*, 03/2024 – current
5. Nicoló Venuti, *Eccentric dynamics of compact binary mergers*, M.Sc. thesis, 02/2024
4. Alexander Neumann, *Gravitational waves from binary neutron stars in the quadrupole approximation*, B.Sc. thesis, 08/2023
3. Sayan Neogi, *Efficient EOB models for generic dynamics*, Summer internship, 06/2023
2. Jacopo Tissino, *Machine Learning for Gravitational Waves*, M.Sc. thesis, 10/2021
1. Alejandra Gonzalez, *EOB models for BHNS coalescences*, M.Sc. thesis, 10/2020

Prizes, awards and grants

First "Geigelstein" prize February 2025
Prize for the best short talk, ***150 EUR*** *Schleching, Germany*

Rhode-Schwartz faculty prize June 2024
Prize for the best Physics Ph.D. thesis, ***1500 EUR*** *Jena, Germany*

Erasmus+ Traineeship 2019
Research grant to support three months in a foreign EU institution, ***2000 EUR*** *Jena, Germany*

INFN-NSF summer exchange grant 2018
Summer research grant to support three months in a US-based institution, ***5000 EUR*** *Fullerton, USA*

Erasmus+ Traineeship 2017
Research grant to support three months in a foreign EU institution, ***2000 EUR*** *Stockholm, Sweden*

PI- and CoI- ships

CoI, INCITE proposal 2025 – current
"Exascale Simulations of Compact Binary Mergers"; 500k GPU/hrs *Aurora, ALCF, USA*

PI, ACCESS proposal 2024 – current
"Specs: Simulating Eccentric, Precessing Compact-binary Systems"; 55k GPU/hrs, ***37000 USD*** *Expanse, SDSC, USA*

CoI, EOB@Work 2023
Grant to support travel and organization costs of the "EOB@Work" workshop, ***3000 EUR*** *Michael Stifel Center Jena*

Technical Skills

Languages: C, Python, Mathematica
Developer Tools: git, CI/CD with GitHub and bitbucket
Libraries: teobresums (maintainter), lalsuite (contributor), bajes (contributor), PyART (maintainter)

Outreach

4. **NP3M K-12 Teachers workshop**: prepared material for the workshop and gave a talk dedicated to GW astronomy, State College (PA), (2025)
3. **Outreach talk** "La gravitá della situazione, da Aristotele a LIGO", Liceo Scientifico di Borgomanero (2023)
2. **Volounteer for Researcher's night** ("La notte dei ricercatori"), Torino (2022)
1. **Outreach talk** "Ascoltando l'universo: e il buco nero come fa?", Liceo Scientifico di Acquiterme (2022)

Other Activities

Member of: the LIGO Scientific Collaboration (LSC), the American Physical Society (APS);
External Referee for Phys. Rev. D, Phys. Rev. Letters, MNRAS, A&A, Particles

Seminars and talks

Invited colloquia and seminars: 10 *invited* presentations

11. **Syracuse University** (SU), 2025: seminar on "Gravitational waves from binary black holes on generic orbits: an effective-one-body approach";
10. **West Virginia University** (WVU), 2025: seminar on "Gravitational waves from generic compact objects: an EOB approach";
9. **University of Milano Bicocca** (UniMiB), 2024: seminar on "Modeling gravitational waves from eccentric, precessing systems";
8. **University of Turin** (UniTO), 2024: seminar on "Modeling gravitational waves from eccentric, precessing systems";

7. **University of California Berkeley** (UCB), 2024: seminar on "Gravitational waves from binary compact objects: and effective one body approach";
6. **University of Barcelona** (UB), 2022: seminar on "TEOBResumS, an advanced waveform model for O4";
5. **University of Illinois-Urbana Champaign** (UIUC), 2022: seminar on "Modeling the full spectrum of gravitational waves from binary neutron stars";
4. **Penn State University** (PSU), 2022: seminar on "Gravitational waves from binary neutron stars";
3. **National Autonomous University of Mexico** (UNAM), 2021: seminar on "The interpretation of GW190521 as a dynamical capture of two binary black holes";
2. **La Sapienza** (Rome), 2020: seminar on waveform systematics for binary neutron star signals;
1. **University College Dublin** (UCD), 2020: seminar on waveform systematics for binary neutron star signals;

Conferences and Workshops: 10 *invited* talks, 1 *contributed* talk

12. **Crossroads25**, (Catania) 2025: invited speaker and panelist for the Waveform Modeling session;
11. **PAX X**, (UIUC) 2025: invited speaker and panelist for the Waveform Modeling session;
10. **DPG** (Goettingen), 2025: invited prize talk on "Fast and Efficient effective one body models for GWs from generic binaries";
9. **Arbeitstreffen Kernphysik in Schleching 54** (Schleching), 2025: invited talk on "Gravitational waves from BNS: modeling and challenges";
8. **TEONGRAV conference** (Rome), 2024: plenary talk on "Constraining the Equation of State with gravitational waves from binary neutron stars";
7. **EOB@Work24** (Jena), 2024: invited talk on "Recent developments in effective one body models: a review";
6. **APS April** (Sacramento), 2024: invited talk on "Constraining the Equation of State with gravitational waves from binary neutron stars";
5. **PAX VIII** (MIT), 2022: invited panelist for the Waveform Modeling session;
4. **PHAROS** (Rome), 2022: invited talk on "Gravitational waves from binary neutron stars";
3. **IPAM** (UCLA), 2022: invited lecture on "Waveform systematics in gravitational-wave signals from binary neutron stars";
2. **DPG** (Heidelberg), 2022: talk on "The interpretation of GW190521 as a dynamical capture of two binary black holes";
1. **H2020** (Austria), 2020: invited talk on the impact of the crust equation of state on the analysis of GW170817 and waveform systematics;

Publications and preprints

41 manuscripts – **9** first authored – of which **33** already published in high-impact, peer-reviewed journals. Preprints under review are indicated with a "■" symbol; work developed independently of my Ph.D. advisor with a "▲" symbol. See also INSPIRE-HEP for a full list.

41. ▲■ Estuti Shukla, Alireza Rashti, **Rossella Gamba**, David Radice, and Koustav Chandra. `GR-Athena++` Simulations of Spinning Binary Black Hole Mergers. 10 2025

40. ■ Luca Nagni, Alessandro Nagar, **Rossella Gamba**, Simone Albanesi, and Sebastiano Bernuzzi. Binary black hole merger in the extreme mass ratio limit: a multipolar analysis of the inclined orbit case. 9 2025

39. ■ Giulia Huez, Sebastiano Bernuzzi, Matteo Breschi, and **Rossella Gamba**. Kilohertz Gravitational Waves from Binary Neutron Star Mergers: Full Spectrum Analyses and High-density Constraints on Neutron Star Matter. 7 2025

38. ■ Alejandra Gonzalez, Sebastiano Bernuzzi, Alireza Rashti, Francesco Brandoli, and **Rossella Gamba**. Black-hole - neutron-star mergers: new numerical-relativity simulations and multipolar effective-one-body model with spin precession and eccentricity. 6 2025

37. ▲ David Radice, **Rossella Gamba**, Hengrui Zhu, and Alireza Rashti. AthenaK simulations of the binary black hole merger GW150914. *Class. Quant. Grav.*, 42(18):185003, 2025

36. ▲ **Rossella Gamba**, Jacob Lange, Danilo Chiaramello, Jacopo Tissino, and Snehal Tibrewal. Revisiting GW150914 with a non-planar, eccentric waveform model. *Class. Quant. Grav.*, 42(17):175014, 2025

35. ■ Giulia Huez, Sebastiano Bernuzzi, Matteo Breschi, and **Rossella Gamba**. Gravitational waves from eccentric binary neutron star mergers: Systematic biases induced by quasi-circular templates. 4 2025

34. ■ Simone Albanesi, **Rossella Gamba**, Sebastiano Bernuzzi, Joan Fontbuté, Alejandra Gonzalez, and Alessandro Nagar. Effective-one-body modeling for generic compact binaries with arbitrary orbits. 3 2025

33. Alireza Rashti, **Rossella Gamba**, Koustav Chandra, David Radice, Boris Daszuta, William Cook, and Sebastiano Bernuzzi. Binary black hole waveforms from high-resolution gr-athena++ simulations. *Phys. Rev. D*, 111(10):104078, 2025

32. ▲ Danilo Chiaramello and **Rossella Gamba**. Horizon absorption on noncircular, planar binary black hole dynamics. *Phys. Rev. D*, 111(2):024024, 2025

31. Simone Albanesi, Alireza Rashti, Francesco Zappa, **Rossella Gamba**, William Cook, Boris Daszuta, Sebastiano Bernuzzi, Alessandro Nagar, and David Radice. Scattering and dynamical capture of two black holes: Synergies between numerical and analytical methods. *Phys. Rev. D*, 111(2):024069, 2025

30. Koustav Chandra, Ish Gupta, **Rossella Gamba**, Rahul Kashyap, Debatri Chattopadhyay, Alejandra Gonzalez, Sebastiano Bernuzzi, and B. S. Sathyaprakash. On the Origins, Remnant, and Multimessenger Prospects of the Compact Binary Merger GW230529. *Astrophys. J.*, 977(2):167, 2024

29. ▲ **Rossella Gamba**, Danilo Chiaramello, and Sayan Neogi. Towards efficient Effective One Body models for generic, non-planar orbits. *Phys. Rev. D*, 110(2):024031, 2024

28. Alessandro Nagar, **Rossella Gamba**, Piero Rettegno, Veronica Fantini, and Sebastiano Bernuzzi. Effective-one-body waveform model for non-circularized, planar, coalescing black hole binaries: the importance of radiation reaction. *Accepted in Phys. Rev. D*, 4 2024

27. Matteo Breschi, **Rossella Gamba**, Gregorio Carullo, Daniel Godzieba, Sebastiano Bernuzzi, Albino Perego, and David Radice. Bayesian inference of multimessenger astrophysical data: Joint and coherent inference of gravitational waves and kilonovae. *Astron. Astrophys.*, 689:A51, 2024

26. Pedro Luis Espino, David Radice, Francesco Zappa, **Rossella Gamba**, and Sebastiano Bernuzzi. Impact of moment-based, energy integrated neutrino transport on microphysics and ejecta in binary neutron star mergers. *Phys. Rev. D*, 109(10):103027, 2024

25. ▲ Tomas Andrade, **Rossella Gamba**, and Juan Trenado. Actively learning numerical relativity. *Phys. Rev. D*, 110(2):024080, 2024

24. Pedro Luis Espino, Peter Hammond, David Radice, Sebastiano Bernuzzi, **Rossella Gamba**, Francesco Zappa, Luis Felipe Longo Micchi, and Albino Perego. Neutrino Trapping and Out-of-Equilibrium Effects in Binary Neutron-Star Merger Remnants. *Phys. Rev. Lett.*, 132(21):211001, 2024

23. Angelica Albertini, **Rossella Gamba**, Alessandro Nagar, and Sebastiano Bernuzzi. Effective-one-body waveforms for extreme-mass-ratio binaries: Consistency with second-order gravitational self-force quasicircular results and extension to nonprecessing spins and eccentricity. *Phys. Rev. D*, 109(4):044022, 2024

22. Gregorio Carullo, Simone Albanesi, Alessandro Nagar, **Rossella Gamba**, Sebastiano Bernuzzi, Tomas Andrade, and Juan Trenado. Unveiling the merger structure of black hole binaries in generic planar orbits. *Phys. Rev. Letters*, 9 2023

21. ■ **Rossella Gamba** et al. Analytically improved and numerical-relativity informed effective-one-body model for coalescing binary neutron stars. 7 2023

20. Tomas Andrade et al. Toward numerical-relativity informed effective-one-body waveforms for dynamical capture black hole binaries. *Phys. Rev. D*, 109(8):084025, 2024

19. Alessandro Nagar, Piero Rettegno, **Rossella Gamba**, Simone Albanesi, Angelica Albertini, and Sebastiano Bernuzzi. Analytic systematics in next generation of effective-one-body gravitational waveform models for future observations. *Phys. Rev. D*, 108(12):124018, 2023

18. Alejandra Gonzalez, **Rossella Gamba**, Matteo Breschi, Francesco Zappa, Gregorio Carullo, Sebastiano Bernuzzi, and Alessandro Nagar. Numerical-relativity-informed effective-one-body model for black-hole–neutron-star mergers with higher modes and spin precession. *Phys. Rev. D*, 107(8):084026, 2023

17. Jacopo Tissino, Gregorio Carullo, Matteo Breschi, **Rossella Gamba**, Stefano Schmidt, and Sebastiano Bernuzzi. Combining effective-one-body accuracy and reduced-order-quadrature speed for binary neutron star merger parameter estimation with machine learning. *Phys. Rev. D*, 107(8):084037, 2023

16. **Rossella Gamba** and Sebastiano Bernuzzi. Resonant tides in binary neutron star mergers: Analytical-numerical relativity study. *Phys. Rev. D*, 107(4):044014, 2023

15. Alice Bonino, **Rossella Gamba**, Patricia Schmidt, Alessandro Nagar, Geraint Pratten, Matteo Breschi, Piero Rettegno, and Sebastiano Bernuzzi. Inferring eccentricity evolution from observations of coalescing binary black holes. *Phys. Rev. D*, 107(6):064024, 2023

14. ■ Matteo Breschi, **Rossella Gamba**, Ssohrab Borhanian, Gregorio Carullo, and Sebastiano Bernuzzi. Kilohertz Gravitational Waves from Binary Neutron Star Mergers: Inference of Postmerger Signals with the Einstein Telescope. 5 2022

13. Angelica Albertini, Alessandro Nagar, Piero Rettegno, Simone Albanesi, and **Rossella Gamba**. Waveforms and fluxes: Towards a self-consistent effective one body waveform model for nonprecessing, coalescing black-hole binaries for third generation detectors. *Phys. Rev. D*, 105(8):084025, 2022

12. **Rossella Gamba**, Sarp Akçay, Sebastiano Bernuzzi, and Jake Williams. Effective-one-body waveforms for precessing coalescing compact binaries with post-Newtonian twist. *Phys. Rev. D*, 106(2):024020, 2022

11. **Rossella Gamba**, Matteo Breschi, Gregorio Carullo, Simone Albanesi, Piero Rettegno, Sebastiano Bernuzzi, and Alessandro Nagar. GW190521 as a dynamical capture of two nonspinning black holes. *Nature Astron.*, 7(1):11–17, 2023

10. Gunnar Riemenschneider, Piero Rettegno, Matteo Breschi, Angelica Albertini, **Rossella Gamba**, Sebastiano Bernuzzi, and Alessandro Nagar. Assessment of consistent next-to-quasicircular corrections and postadiabatic approximation in effective-one-body multipolar waveforms for binary black hole coalescences. *Phys. Rev. D*, 104(10):104045, 2021

9. Matteo Breschi, **Rossella Gamba**, and Sebastiano Bernuzzi. Bayesian inference of multimessenger astrophysical data: Methods and applications to gravitational waves. *Phys. Rev. D*, 104(4):042001, 2021

8. Daniel A. Godzieba, **Rossella Gamba**, David Radice, and Sebastiano Bernuzzi. Updated universal relations for tidal deformabilities of neutron stars from phenomenological equations of state. *Phys. Rev. D*, 103(6):063036, 2021

7. **Rossella Gamba**, Sebastiano Bernuzzi, and Alessandro Nagar. Fast, faithful, frequency-domain effective-one-body waveforms for compact binary coalescences. *Phys. Rev. D*, 104(8):084058, 2021

6. Stefano Schmidt, Matteo Breschi, **Rossella Gamba**, Giulia Pagano, Piero Rettegno, Gunnar Riemenschneider, Sebastiano Bernuzzi, Alessandro Nagar, and Walter Del Pozzo. Machine Learning Gravitational Waves from Binary Black Hole Mergers. *Phys. Rev. D*, 103(4):043020, 2021

5. Alessandro Nagar, Piero Rettegno, **Rossella Gamba**, and Sebastiano Bernuzzi. Effective-one-body waveforms from dynamical captures in black hole binaries. *Phys. Rev. D*, 103(6):064013, 2021

4. **Rossella Gamba**, Matteo Breschi, Sebastiano Bernuzzi, Michalis Agathos, and Alessandro Nagar. Waveform systematics in the gravitational-wave inference of tidal parameters and equation of state from binary neutron star signals. *Phys. Rev. D*, 103(12):124015, 2021

3. Sarp Akcay, **Rossella Gamba**, and Sebastiano Bernuzzi. Hybrid post-Newtonian effective-one-body scheme for spin-precessing compact-binary waveforms up to merger. *Phys. Rev. D*, 103(2):024014, 2021

2. ▲ Alessandro Nagar, Geraint Pratten, Gunnar Riemenschneider, and **Rossella Gamba**. Multipolar effective one body model for nonspinning black hole binaries. *Phys. Rev. D*, 101(2):024041, 2020

1. ▲ **Rossella Gamba**, Jocelyn S. Read, and Leslie E. Wade. The impact of the crust equation of state on the analysis of GW170817. *Class. Quant. Grav.*, 37(2):025008, 2020

LVK papers with significant contribution

Paper writing team member of the following LIGO-Virgo-KAGRA (LVK) Collaboration papers:

2. GW230814: investigation of a loud gravitational-wave signal observed with a single detector. 9 2025

1. B. P. Abbott et al. GW190425: Observation of a Compact Binary Coalescence with Total Mass $\sim 3.4 M_\odot$. *Astrophys. J. Lett.*, 892(1):L3, 2020