1 Curriculum vitae

1.1 PERSONAL INORMATION

Name: Guglielmo Lami
Date of birth: 28/09/1995
Place of birth: Pisa (Italy)
Nationality: Italian
ORCID: 0000-0002-1778-7263

1.2 LANGUAGES

Italian: Proficient (native language)
English: Advanced
French: Upper Intermediate

1.3 EDUCATION AND CAREER

- **Post-Doc researcher** 01/2024 - present
  Laboratory of Theoretical Physics and Modelling (LPTM), Cergy Paris University
  Jacopo De Nardis' group

- **PhD in Theory and Numerical Simulation of Condensed Matter** 10/2019 - 12/2023
  SISSA (Scuola Internazionale Superiore di Studi Avanzati), Trieste
  PhD award date: 18/12/2023
  Thesis title: "*Pushing the boundaries of Matrix Product States in quantum many-body physics and computing*"
  Advisor: Prof. Mario Collura

- **Master Degree in Theoretical Physics** 09/2017 - 10/2019
  Università di Pisa, Final grade: 110/110 *cum Laude*
  Master's degree award date: 16/10/2019
  Thesis title: "*Localization of kinks in discrete classical models*"
  Supervisor: Prof. Alessandro Silva

- **Degree Course in Physics** 09/2014 - 07/2017
  Università di Pisa, Final grade: 110/110 *cum Laude*
  Thesis title: "*The exact solution of the 2D Ising model*"

- **High School** 09/2009 - 01/2014
  Liceo Scientifico Ulisse Dini (Pisa), Final grade: 100/100

1.4 INFORMATICS AND CODING SKILLS

Languages	Python, Wolfram Mathematica, Julia, C++
Frameworks and Tools	Numpy, Keras, iTensor, NetKet, Stim, Git

The applicant possesses a profound experience in developing Tensor Network algorithms, including those for: quantum ground states (DMRG), time-evolution (TEBD, TDVP), quantum annealing, operator spreading, temporal entangle-

ment. While he has independently implemented these algorithms without relying on pre-existing packages, he is also able to interface his code with established tools like iTensor.

The applicant also has extensive experience in optimized exact diagonalization methods for quantum many-body systems. Additionally, he has considerable expertise in utilizing Neural Networks, particularly for quantum many-body systems, including the optimization of quantum Neural Networks using the NetKet package.

The applicant also has excellent practical knowledge of packages used in the simulation of Stabilizer states and Clifford circuits (such as the Stim package).

1.5 PUBLICATIONS

- "*Anticoncentration of random tensor network states*"
  G. Lami, Jacopo De Nardis, Xhek Turkeshi arXiv:2409.xxxxx [quant-ph] (2024)
  In preparation
- "*Clifford Dressed Time-Dependent Variational Principle*"
  A.F. Mello, A. Santini, **G. Lami**, J. De Nardis and M. Collura, arXiv:2407.01692 [quant-ph] (2024)
  doi: https://doi.org/10.48550/arXiv.2407.01692
- "*Variational ground-state quantum adiabatic theorem*"
  B. Žunković, P. Torta, G. Pecci, **G. Lami** and M. Collura, arXiv:2406.12392 [quant-ph] (2024)
  doi: https://doi.org/10.48550/arXiv.2406.12392
- "*Estimating Non-Stabilizerness Dynamics Without Simulating It*"
  A. Paviglianiti, **G. Lami**, M. Collura and A. Silva, arXiv:2405.06054 [quant-ph] (2024)
  doi: https://doi.org/10.48550/arXiv.2405.06054
- "*Quantum State Designs with Clifford Enhanced Matrix Product States*"
  G. Lami, T. Haug and J. De Nardis, arXiv:2404.18751 [quant-ph] (2024)
  doi: https://doi.org/10.48550/arXiv.2404.18751
- "*Retrieving Non-Stabilizerness with Neural Networks*"
  A.F. Mello, **G. Lami** and M. Collura, arXiv:2403.00919 [quant-ph] (2024)
  doi: https://doi.org/10.48550/arXiv.2403.00919
- "*Unveiling the Stabilizer Group of a Matrix Product State*"
  G. Lami and M. Collura, Phys. Rev. Lett. 133, 010602 (2024)
  doi: 10.1103/PhysRevLett.133.010602
- "*Continuously Monitored Quantum Systems beyond Lindblad Dynamics*"
  G. Lami, A. Santini and M. Collura, New J. Phys. 26, 023041 (2024)
  doi: 10.1088/1367-2630/ad1f0a
- "*Quantifying Nonstabilizerness through Entanglement Spectrum Flatness*"
  E. Tirrito, P. S. Tarabunga, **G. Lami** et al., Phys. Rev. A 109, L040401 (2024)
  doi: 10.1103/PhysRevA.109.L040401
- "*Nonstabilizerness via Perfect Pauli Sampling of Matrix Product States*"
  G. Lami, M. Collura, Phys. Rev. Lett. 131, 180401 (2023)
  doi: 10.1103/PhysRevLett.131.180401
- "*Quantum Annealing for Neural Network Optimization Problems: A New Approach via Tensor Network Simulations*"
  G. Lami, P. Torta, G. E. Santoro, M. Collura, SciPost Phys. 14, 5, 117 (2023)
  doi: 10.21468/SciPostPhys.14.5.117
- "*Matrix Product States with Backflow Correlations*"
  G. Lami, G. Carleo, M. Collura, Phys. Rev. B 106, L081111 (2022)
  doi: 10.1103/PhysRevB.106.L081111

1.6 BOOKS

- "*Applied Tensor Networks: a Quantum Computing Practical Perspective*"
  M. Collura, **G. Lami** N. Ranabhat, A. Santini (2024)
  SISSA Medialab
  In preparation

1.7 PEER-REVIEW ACTIVITY

The applicant actively contributes to the refereeing process for the following international peer-reviewed scientific journals: - Physical Review Letters; - SciPost Physics.

1.8 TEACHING AND SUPERVISING EXPERIENCES

- "Quantumandu" summer school 25/07/2024 - 31/07/2024
  The school was part of the Physics Without Frontiers program of the ICTP. The applicant taught a 9-hour in-person course on Numerical Simulation of Quantum Many-Body Systems.
  Central Department of Physics, Tribhuvan University, Kathmandu, Nepal
- Co-supervision with Prof. M. Collura of A. F. Mello's master thesis (University of Trieste) 04/2023 - 10/2023
- Tutorial on Matrix Product States and DMRG for First Year PhD students 04/2021
  SISSA, Trieste
- Assistant of Prof. S.Capaccioli at the course of General Physics 02/2019 - 07/2019
  Faculty of Agriculture, Università di Pisa

1.9 ORGANISATION OF SCIENTIFIC EVENTS

Co-organizer and main lecturer of the ICTP founded Physics Without Frontiers (PWF) event "Quantumandu", a school focused on Numerical Simulation of Quantum Many-Body Systems. Held at the Central Department of Physics, Tribhuvan University in Kathmandu (Nepal) from July 25 to July 31, 2024, this event aimed to equip Master's level physics students in Nepal with advanced numerical methods in quantum many-body physics. Played a key role in organizing and delivering the program, addressing the specific needs of local students. Achieved successful collaboration with co-organizers PhD Nishan Ranabhat, Prof. Narayan Adhikari and the PWF co-cordinator Dr. Natasa Stojic. The school saw the in-person participation of 30 local master's students. The feedback was positive and the event was deemed a success.

1.10 WORKSHOPS, CONFERENCES, SCHOOLS, SEMINARS

Seminars

- Invited seminar at University of Amsterdam 25/06/2024
  QAMBS series on Quantum Algorithms for Many Body Systems
  Title: "Quantum magic and Matrix Product States"
- Invited seminar at the Budapest Integrability Events 25/05/2023
  Title: "Quantum Magic: from perfect Pauli sampling to entanglement spectrum flatness"
- Invited seminar on "Neural networks in the quantum world: two case studies" 14/02/2023
  Laboratory of Theoretical Physics and Modelling (LPTM), Cergy Paris University

- Invited seminar at Prof. W.Lechner Group's Meeting 21/09/2022
  University of Innsbruck
  Title: "Quantum Annealing for Neural Network optimization problems"

Talks

- First workshop on Many-body quantum magic (MBQM2024) 18/11/2024 - 20/11/2024
  Technology Innovation Institute (TII), Abu Dhabi (United Arab Emirates)
  Invited Talk
- Novel Emergent Phenomena in Quantum Many-Body Dynamics 25/10/2024 - 30/10/2024
  Les Houches (France)
  Invited Talk on "Quantum State Designs with Clifford Enhanced Matrix Product States"
- Italian Quantum Information Science Conference (IQIS) 18/09 - 22/09/2023
  University of Trieste, Trieste (Italy)
  Invited Talk on "Quantum magic via perfect Pauli sampling of matrix product states"
- Annual Trieste-Padova meeting 27/02/2023
  SISSA, Trieste (Italy)
  Invited Talk on "Optimization of a perceptron under Quantum Annealing protocol"
- Quantum Techniques in Machine Learning (QTML) 07/11/2022 - 12/11/2022
  Napoli (Italy)
  Talk on "Quantum Annealing for Neural Network optimization problem"
- Machine Learning for Quantum Control and Quantum Computing 29/08/2022 - 02/09/2022
  Nordic Institute for Theoretical Physics, Stockholm (Sweden)
  Talk on "Quantum Annealing for Neural Network optimization problem"
- Second Adriatic Conference on Strongly Correlated Systems (and beyond) 16/02/2022 - 18/02/2022
  ICTP, Trieste (Italy)
  Invited Talk on "A Neural-Tensor mixed strategy for high-dimensional Quantum Many-Body optimisation"

Posters

- Italian Quantum Information Science Conference (IQIS) 16/09/2024 - 20/09/2024
  Pizzo Calabro (Italy)
  Poster on "Quantum State Designs with Clifford Enhanced Matrix Product States"
- Physics of Quantum information conference 27/05/2024 – 31/05/2024
  Perimeter Institute for Theoretical Physics, Waterloo (Ontario, Canada)
  Poster on "Quantum State Designs with Clifford Enhanced Matrix Product States"
- Quantum many-body systems out-of-equilibrium 08/01/2024 - 22/03 2024
  Institut Henri Poincaré, Paris (France)
  Poster on "Unveiling the Stabilizer Group of a Matrix Product State"
- Quantum Techniques in Machine Learning (QTML) 19/11/2023 - 25/2023/2023
  CERN, Geneva (Switzerland)
  Poster on "Quantum magic via perfect Pauli sampling of matrix product states"
- New perspectives in the out-of-equilibrium dynamics
  of open many-body quantum systems (OpenQMB2023) 19/06/2023 - 30/06/2023
  Institut Pascal, Paris Saclay (France)
  Poster on "Quantum magic via perfect Pauli sampling of matrix product states"
- Dynamics and Complexity (DCP) 07/06/2023 - 09/06/2023
  University of Pisa, Pisa (Italy)
  Poster on "Continuously Monitored Quantum Systems Beyond Lindblad Dynamics"
- Quantum Science Generation 02/05/2023 - 05/05/2023
  Trento (Italy)

Poster on “Quantum magic via perfect Pauli sampling of matrix product states”

Other attended events

- Symposium “Open questions in the quantum many-body problem” 08/07/2024 - 12/07/2024
  Institut Henri Poincaré, Paris (France)
- Workshop on Dynamics of Monitored Quantum Many-Body Systems 21/08/2023 - 25/08/ 2023
  ICTP, Trieste (Italy)
- Quantum Artificial Intelligence (QAI) 27/07/2023 - 28/07/2023
  Napoli (Italy)
- 9th Trieste–Ljubljana-Zagreb meeting 14/03/2023
  Jozef Stefan Institute JSI, Ljubljana, (Slovenia)
- First TQT-QTN School on Quantum Science and Technology 14/09/2022 - 16/09/2022
  Trento (Italy)
- Quantum Dynamics: From Electrons to Qbits 22/08/2022 - 9/09/2022
  ICTP, Trieste (Italy)
- Conference on Adiabatic Quantum Computation/Quantum Annealing 20/06/2022 - 24/06/2022
  ICTP, Trieste (Italy)
- Clean and disordered systems out of equilibrium 14/09/2020 - 18/09/2020
  Summer School, Cargèse (France)

1.11 OUTREACH

- Talk “Perspectives on the second quantum revolution” 31/07/2024
  Audience: general public
  Tribhuvan University, Kathmandu, Nepal

- Talk “Entanglement: una proprietà importante del mondo quantistico” 06/04/2022
  Audience: science high school class
  Italian quantum weeks, Trieste (Italy)

1.12 OTHER INTERESTS

-Social engagement: commitment to fostering a more open and diverse scientific community. Dedicated to supporting underrepresented groups, including those from economically disadvantaged backgrounds. The applicant co-organized a Physics Without Frontiers program in Nepal.

-Music: strong passion for music, with proficiency in piano playing.

-Authored several publications at the intersection of music and physics, including:

- C. Bini, D. Capecchi, I. Chinnici, G. Capecchi, **G. Lami**, “*The musical systems by Rameau and Tartini: creativity and inconsistency*”, in Atti del XLI Convegno annuale, Società italiana degli storici della fisica e dell’astronomia, Pisa University Press, Arezzo, 6-9 September 2021, pp. 62-67, 2022.
- C. Bini, D. Capecchi, G. Capecchi and **G. Lami**, “*The combination tones: from Tartini to Helmholtz*”, in Atti del XLI Convegno annuale, Società italiana degli storici della fisica e dell’astronomia, Pisa University Press, Arezzo, 6-9 September 2021, pp. 68-73, 2022.
- C. Bini and **G. Lami**, “*I suoni di combinazione ed il terzo suono di Tartini: fisica, storia e musica*”, Campano Edizioni, ISBN 978-88-6528-458-2, pp. 41, 2019.