

DICHIARAZIONE SOSTITUTIVA DI CERTIFICAZIONE
Art. 46 del DPR 445 del 28/12/2000

Il sottoscritto COLLURA MARIO, nato a PALERMO (PA) e residente a TRIESTE(TS)
consapevole delle responsabilità penali previste dagli artt. 75 e 76 del DPR 445/2000
per le ipotesi di falsità in atti e dichiarazioni mendaci

DICHIARA LE SEGUENTI INFORMAZIONI

Mario Collura

Place of Birth: Palermo, Italy
Citizenship: Italian

CONTACT INFORMATION

Current Position: Associate Professor
Condensed Matter Group
SISSA, Trieste, Italy

EDUCATION

1996-2001 Scientific High School in Palermo, Italy
July 2001 High School Leaving Exam: 100/100
10/2001-12/2004 Bachelor studies in Physics, Palermo University
Bachelor in Physics: 110/110 *cum laude*
Title of Thesis: “Quantum shift registers in a quantum computer: a microscopical model”
01/2005-09/2008 Master studies in Physics, Pisa University
Master in Theoretical Physics: 110/110 *cum laude*
Title of Thesis: “Out-of-equilibrium relaxational dynamics on three-dimensional Ising model”
01/2009 - 02/2012 PhD in Statistical Physics of Complex Systems, Nancy University
Title of Thesis: “Nonequilibrium aspects in strongly correlated one-dimensional quantum systems”

PROFESSIONAL EXPERIENCE

05/2012 - 08/2014 Postdoctoral Researcher, Pisa University (Pisa, Italy)
09/2014 - 06/2016 Postdoctoral Researcher, Statistical Physics Group, SISSA (Trieste, Italy)
10/2016 - 09/2018 Marie Curie Fellow, Rudolf Peierls Centre for Theoretical Physics (Oxford, United Kingdom)
10/2018 - 08/2019 Fixed-term Researcher, Saarland University (Saarbrücken, Germany)
10/2018 - 08/2019 Long-term Visiting Researcher, Padova University (Padova, Italy)
09/2019 - 08/2022 RTDB (Assistant Professor), Condensed Matter Group, SISSA (Trieste, Italy)
09/2022 - present Associate Professor, Condensed Matter Group, SISSA (Trieste, Italy)

KEY COLLABORATIONS

Collaborators: B. Bertini (Ljubljana), P. Calabrese (SISSA), G. Carleo (EPFL), A. De Luca (Paris),
J. De Nardis (Ghent), J. Dubail (Nancy), D. Karevski (Nancy), F. Essler (Oxford),
M. Fagotti (Paris), A. Gambassi (SISSA), M. Kormos (Budapest), S. Montangero (Padova),
G. Roux (Paris), G. Santoro (SISSA), P. Silvi (Innsbruck), S. Sotiriadis (Ljubljana),
G. Takács (Budapest), J. Viti (Natal).

RESEARCH FOCUS AND CONTRIBUTIONS

I specialize in the non-equilibrium dynamics of many-body quantum systems, with extensive expertise in developing and applying numerical tools based on Tensor Network descriptions. My research has significantly advanced the field through:

- **Development of Tensor Network Algorithms:** Created and refined algorithms for Matrix Product States (MPS) and Matrix Product Density Operators (MPDO), enhancing the efficiency and accuracy of quantum state simulations. - **Strongly Interacting Systems:** Developed a framework to compute the exact dynamics of correlation functions in strongly interacting bosonic systems. - **Semiclassical Approaches:** Applied semiclassical methods to analyze dynamical confinement in non-integrable spin chains. - **Generalized Hydrodynamics:** Contributed to the development of generalized hydrodynamics, deriving a continuity equation that describes the late-time dynamics of inhomogeneous states in interacting integrable models. - **Stabiliser formalism and quantum magic:** Contributed to the development of cutting-edge approaches integrating Clifford manipulations with tensor network techniques, enhancing the ability to quantify non-stabilizerness and non-Gaussianity in many-body quantum systems.

LEADERSHIP AND SERVICE

As a leader in the Condensed Matter Group at SISSA, I have demonstrated strong organizational and collaborative skills through:

- **Organizing and Co-Organizing Events:** Successfully organized and co-organized major conferences and workshops, including the Young Italian Quantum Information Science Conference 2020 and the Virtual Winter School on Strongly Correlated Quantum Matter. - **Mentoring and Advising:** Provided guidance to numerous PhD and Master's students, contributing to their academic and professional development. Actively involved in the supervision and co-advising of research projects. - **Teaching:** Developed and taught advanced courses on topics such as Tensor Network Methods and Generalized Hydrodynamics, influencing the next generation of physicists. - **Leadership and Commitments:** Since the fall of 2019, I have served as the Vice-Coordinator of the Condensed Matter Theory Group at SISSA, where I contribute to the strategic coordination and development of research activities within the group. Additionally, I represent SISSA as a delegate in the RUS (Rete delle Università per lo Sviluppo Sostenibile), an Italian network dedicated to promoting and sharing best practices for sustainability across universities. Through this role, I actively participate in initiatives aimed at fostering sustainable development within academic institutions and beyond.

SELECTED GRANTS AND AWARDS

2016 Marie Curie Individual Fellowship:	185k€
2018 ACRI Fellowship:	3k€
2023 PRIN 2022 project 2022R35ZBF - ManyQLowD	200k€
2023 PNRR MUR project PE0000023 - NQSTI	70k€

ORGANISED EVENTS

- **Young Italian Quantum Information Science Conference 2020 (YIQIS2020):** Organized from September 28, 2020, to October 2, 2020. [Link to Event](<https://agenda.infn.it/event/23347/>)
- **Virtual Winter School on Strongly Correlated Quantum Matter:** Co-organized with ICTP (Trieste) and MPIPKS (Dresden) from November 30, 2020, to December 18, 2020. [Link to Event](<https://www.pks.mpg.de/scqm20/>)

INTERNATIONAL ACTIVITY

- **Collège Doctoral franco-allemand:** Grant for a one-year visit to the Institut für Theoretische Physik, Leipzig University (July 2009 - June 2010).
- **BRISP Project:** Assisted in the setup of the thermal neutrons monochromator at the Institut Laue-Langevin in Grenoble, France (May 2005). [Supervisor: A. Orecchini].

TEACHING EXPERIENCE

- **Luxembourg University:** Course on “Méthodes mathématiques de la Physique [Mathematical Methods of Physics]” for undergraduate students (October 2010 - January 2011).
- **SISSA:** Courses on “Density Matrix Renormalization Group in a Nutshell” (March - April 2015 and March - April 2016), “Computer Simulation of Condensed Matter” (2019 - present), “Tensor Network Methods for Quantum Computing” (2020 - present).
- **Oxford University:** Tutoring Class on “Quantum Matter Physics” (February - March 2017).
- **Nancy (France):** Course on “Tensor Network Methods for Strongly Correlated One-Dimensional Quantum Systems” during the School on Introduction to Out-of-Equilibrium Quantum Many-Body Physics (November 25 - 29, 2019).

RESEARCH PROJECTS

- **PRIN 2022 project 2022R35ZBF:** “ManyQLowD” (2023 - 2025): Principal Investigator.
- **PNRR MUR project PE0000023 - NQSTI:** “National Quantum Science and Technology Institute” (2023 - 2025): Research Unit Leader.

PHD AND MASTER’S THESIS SUPERVISION

- **PhD Students:** Supervised multiple PhD students in various stages of their research, focusing on topics related to non-equilibrium quantum dynamics and tensor network methods.
- **Master Theses:** Supervised and co-supervised several Master’s theses in theoretical and computational physics, providing guidance on research methodologies and thesis writing.

CONFERENCES AND SCHOOLS

- **Invited Speaker:** Presented at international conferences such as “Many-body Quantum Magic 2024,” “Recent Trends in Quantum Computing and Quantum Technologies,” and “Statistical Physics of Low-Dimensional Systems.”
- **Contributed Talks:** Delivered talks at various workshops and summer schools, sharing insights on the latest advancements in quantum many-body physics and numerical methods.

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