

ALESSANDRO SANTINI

Quantum Algorithm Developer

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PROFESSIONAL SUMMARY

Quantum Algorithm Developer at Pasqal, building software primitives for neutral-atom quantum hardware. PhD (SISSA) and postdoc (École Polytechnique) in quantum many-body physics, specializing in tensor networks, neural-network quantum states, and variational Monte Carlo. Skilled in Python/JAX, Julia/ITensor, and GPU-based HPC. Author of 18 peer-reviewed publications (PRL, PRX Quantum, PRB) and co-author of a monograph on tensor network techniques.

KEY COMPETENCIES

- Quantum algorithms & simulation
- Tensor networks (MPS, DMRG, TDVP)
- Neural-network quantum states (NQS)
- Variational Monte Carlo methods (VMC)
- Python (JAX/Flax/Optax), Julia (ITensor)
- HPC / GPU workflows (SLURM)
- Open-source development (NetKet)
- Quantum information theory & entanglement

PROFESSIONAL EXPERIENCE

Quantum Algorithm Developer *June 2026 - Present*

Pasqal

- Developing hardware-oriented software and algorithms for the Primitives Team at Pasqal, contributing to core building blocks for quantum computation on neutral atom hardware.

Postdoctoral Researcher *Nov 2024 – June 2026*

Centre de Physique Théorique (CPHT), École Polytechnique / Institut Polytechnique de Paris, and Collège de France

Supervisor: Prof. Filippo Vicentini

- Developing machine-learning methods for quantum many-body simulation, including neural-network quantum states and foundation-model approaches for variational wavefunctions.
- Contributing to the NetKet open-source codebase (JAX-based framework for variational quantum simulation).

PhD Researcher in Condensed Matter Physics *Oct 2020 – Oct 2024*

SISSA — International School for Advanced Studies, Trieste, Italy (cum laude)

Advisors: Prof. M. Collura, Prof. G. E. Santoro

- Training in computational quantum physics. Co-supervised PhD students.
- Developed tensor network algorithms, investigated measurement-induced phase transitions, quantum thermodynamics, and non-equilibrium dynamics using exact and tensor-network methods.
- Co-authored a monograph on tensor network techniques for quantum computation (SCOAP3 / open access).
- Elected member of the Board of Directors, SISSA (2022–2024).

EDUCATION

Ph.D. in Condensed Matter Physics (cum laude) *Oct 2020 – Oct 2024*

SISSA, Trieste, Italy

Thesis: “Advanced Perspectives in Non-Equilibrium Quantum Dynamics”

M.Sc. in Physics (110/110 cum laude) *Oct 2018 – Jul 2020*

Università degli Studi di Firenze, Italy

B.Sc. in Physics (110/110) Oct 2014 – Apr 2018

Università degli Studi di Firenze, Italy

TECHNICAL SKILLS

Languages	Python (expert), Julia, Mathematica, Bash
ML / Scientific	JAX, Flax, Optax, NetKet, NumPy, SciPy, HDF5
Tensor Networks	ITensor (Julia), custom MPS/DMRG/TDVP implementations
HPC	SLURM, GPU workflows (CUDA)
Dev Tools	Git/GitHub, FAIR data practices
Writing	LaTeX, scientific publishing, grant writing (MSCA, GENCI)
Languages	Italian (native), English (C1), French (B1)

SELECTED PUBLICATIONS18 peer-reviewed publications | ~350 citations | *h-index 10* (Google Scholar)

1. A. Santini, S. Barison, F. Vicentini, Classically Prepared, Quantumly Evolved: Hybrid Algorithm for Molecular Spectra, arXiv:2510.24911 (2025), submitted to npj Quantum Information.
2. A. Shokry, A. Santini, F. Vicentini, When Less is More: Approximating the Quantum Geometric Tensor with Block Structures, DiffSys Workshop, EurIPS 2025 (OpenReview), arXiv:2510.08430.
3. A. Misery, L. Gravina, A. Santini, F. Vicentini, Looking Elsewhere: Improving Variational Monte Carlo Gradients by Importance Sampling, Mach. Learn.: Sci. Technol. 7 015035 (2026)
4. A. F. Mello, A. Santini, M. Collura, *Hybrid Stabilizer Matrix Product Operator*, Phys. Rev. Lett. 133 (2024)
5. A. F. Mello, A. Santini, G. Lami, J. De Nardis, M. Collura, *Clifford-Dressed Time-Dependent Variational Principle*, Phys. Rev. Lett. 134 (2025)
6. A. Solfanelli, A. Santini, M. Campisi, *Experimental Verification of Fluctuation Relations with a Quantum Computer*, PRX Quantum 2 (2021)
7. A. Santini, V. Vitale, *Experimental Violations of Leggett–Garg Inequalities on a Quantum Computer*, Phys. Rev. A 105 (2022)

Book: M. Collura, G. Lami, N. Ranabhat, A. Santini — *Tensor Network Techniques for Quantum Computation*, SISSA Medialab (2024)

GRANTS & AWARDS

- **2025:** Hi! PARIS Postdoctoral Fellowship (2025-2027)

Two-year fellowship at the AI & Data Analytics center of IP Paris / HEC Paris.

- **2023:** Ermenegildo Zegna Founder's Scholarship (Erasmus+ in LPTM and LPTMS during PhD)

ADDITIONAL ACTIVITIES

- Co-supervision of PhD students (A. F. Mello, A. Misery) and M2 interns (N. Moumiqué).
- Contributor to NetKet, an open-source JAX framework for variational quantum simulation.
- Reviewer for Physical Review A, Physical Review E, Journal of Statistical Physics, Scipost.
- Conference and seminar presentations at IQIS, QSG, ICoQC, OPEN QMBP, Institut Pascal, SIFS.