Antonio Anna Mele

Curriculum Vitae

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Birth date: 22/08/1997
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Short profile

Current status: PhD student at Freie Universität Berlin, Jens Eisert group.

Research interests: Theory of Quantum Information and Computing. AI and Machine Learning.

`https://antonioannamele.com`

Education

2021 – Now **PhD in Quantum Information**, Freie Universität Berlin.
Advisor: Jens Eisert

2019 – 2021 **Master degree in Physics**, Double degree UNITN-SISSA.
University of Trento, Trento. *SISSA/ISAS - International School for Advanced Studies*, Trieste.
Final grade: 110/110 cum Laude, 20/10/2021. *Exams average*: 30/30 (maximum).

2016 – 2019 **Bachelor degree in Physics**, *University of Pisa*, Pisa.
Final grade: 110/110 cum Laude, 27/06/2019.

Academic papers

- Learning fermionic correlations by evolving with random translationally invariant Hamiltonians. J. Denzler, **A.A. Mele**, E. Derbyshire, T. Guaita, J. Eisert. ArXiv preprint arXiv:2309.12933, 2023.
- Introduction to Haar Measure Tools in Quantum Information: A Beginner's Tutorial. **A.A. Mele**. ArXiv preprint arXiv:2307.08956, 2023.
- J.J. Meyer, M. Mularski, E. Gil-Fuster, **A.A. Mele**, F. Arzani, A. Wilms, J. Eisert. Exploiting symmetry in variational quantum machine learning. PRX Quantum 4 (1), 010328, 2023.
- Avoiding barren plateaus via transferability of smooth solutions in Hamiltonian Variational Ansatz. **A.A. Mele**, G.B. Mbeng, G.E. Santoro, M. Collura, P. Torta. Physical Review A 106 (6), L060401, 2022
- Stochastic noise can help to avoid saddle points in variational quantum algorithms. J. Liu, F. Wilde, **A.A. Mele**, L. Jiang, J. Eisert. ArXiv preprint, arXiv:2210.06723, 2022.

Teaching

2022 – 2023 Quantum information theory (tutorials). `https://antonioannamele.com/teaching/`

Talks and Poster

02/2023 Avoiding barren plateaus via transferability of smooth solutions in Hamiltonian Variational Ansatz, QIP 2023 (poster).

09/2022 Avoiding barren plateaus via transferability of smooth solutions in Hamiltonian Variational Ansatz, DPG conference (talk).

09/2021 Exploiting symmetry in variational quantum machine learning, DPG conference (talk).

11/2022 Avoiding barren plateaus via transferability of smooth solutions in Hamiltonian Variational Ansatz, QTML 2022 (Extendend talk).

Partecipation in Schools and Workshops

08/2023 QMATH Masterclass on Quantum Learning Theory, University of Copenhagen.

07/2023 PCMI 2023 Graduate Summer School in Quantum Computation. IAS/Park City Mathematics Institute.

08/2022 QMATH Masterclass on Entropy Inequalities in Quantum Information Science, University of Copenhagen.

Review activity

Journals Quantum

npj Quantum Information

Conferences 27th Conference on Quantum Information Processing (QIP 2024)

17th Conference on Theory of Quantum Computation, Communication and Cryptography (TQC 2023)

26th Conference on Quantum Information Processing (QIP 2023)

Quantum Techniques in Machine Learning 2022 (QTML 2022)

Bachelor and Master thesis

Master Title: Quantum Approximate Optimization Algorithm for Quantum Many-Body States Preparation.

Advisors: Mario Collura & Philipp H.J. Hauke.

Bachelor Title: How to break down quantum noise in a gravitational waves detector.

Advisor: Giancarlo Cella.

Master courses

During my master degree, I had the opportunity to attend various PhD courses in SISSA, in addition to the master courses in University of Trento, including:

UNITN:

- Statistical mechanics (30L/30) - R. Potestio
- Experimental methods (30/30) - S. Vitale
- Quantum Field Theory I (30/30) - A. Perego
- Quantum Mechanics, fields and symmetries (30/30) - W. Leidemann
- Nuclear and subnuclear physics (30L/30) - W. Leidemann
- Solid state physics I (30L/30) - G. Baldi
- Computational physics (30/30) - F. Pederiva
- Quantum computing (30L/30) - P. Hauke
- Quantum Machine Learning (30/30) - D. Pastorello
- General relativity and Cosmology (Attended course) - M. Rinaldi

SISSA:

- Many-Body Simulations I. Stochastic methods: from Langevin dynamics to Quantum Monte Carlo (30/30) - S. Sorella
- Many-Body Simulations II. Exact and Renormalisation methods: from Lanczos to Tensor Networks (28/30) - M. Collura
- Electronic bands and phonon dispersions: theory and applications (30L/30) - A. Dal Corso
- Quantum Many Body Systems and Strongly Correlated Electrons I (30L/30) - M. Capone
- Quantum Many Body Systems and Strongly Correlated Electrons II (30L/30) - M. Fabrizio
- The quantum Ising chain for beginners (30L/30) - G. Santoro
- Hubbard model dynamical correlation function via Lanczos Techniques (30L/30) - M. Collura
- Application of basic quantum Monte Carlo methods to a toy model on a lattice (30/30) - S. Sorella
- Entanglement Entropy and Quantum Field Theories (30/30) - P. Calabrese
- Algorithmic differentiation for electronic simulations (Attended course) - S. Sorella
- Introduction to Quantum Information and Computation (30L/30) - G. Santoro, R. Fazio

- Machine Learning for Material Science (30/30) - S. De Gironcoli

Computer Skills

Languages and Softwares: Python, C/C++, Fortran, Mathematica, HTML, CSS.

Frameworks for Quantum Computing e.g. *QisKit*, *Pennylane*, *CirQ*.

Good Arduino skills (plus, implemented a robotic hand as project for high school thesis).

Video-editing: Final Cut Pro.

Languages

Italian: Native.

English: Advanced. Master and PhD programme in English. FCE certificate.

German: Basic knowledge.

Experiences and Awards

2019 **UNITN-SISSA**: Scholarship for admission to Master Programme. Selected through a competition based on a physics written and oral exam.

2019 **Laude Bachelor Ceremony**: Partecipation at ceremony for awarding diplomas to graduates *cum Laude*.

2018-2019 **Lead The Future**: Selected as Mentee in *LeadTheFuture*. With the acceptance rate below 20 %, it is an organization that empowers top-performing students to achieve their goals by providing prestigious mentorship coming from the world's leading STEM innovation hubs such as Silicon Valley and CERN.

2015 **Physics, Chemistry and Informatics Olympiad**: Partecipation at the national finals of the National Informatics Olympiad and at both the regional phases of Physics and Chemistry olympiads.

2020 **Samsung innovation Camp**: 25 hours of online training and a Project Work on the main digital disciplines: marketing, communication, business, data analytics, innovative use of technologies, privacy and online security.

2015-2016 **IoStudio**: Competition of MIUR and SAMSUNG. Winner for programming an Android App for my high school.

Other Experiences

- Representative of high school student body for two years (2014-15 and 2015-16).
- FIGC football referee (2014-15).
- Math, physics and programming mentor for students.