Lorenzo Leone

Contact Information

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Homepage: Lorenzo Leone's personal webpage

Citizenship

Italy

Who am I

I am a Ph.D. student whose main interest is Quantum Information Theory, a broad field able to touch many topics in quantum physics. My research activity involves topics such as Quantum Chaos and quantum complexity. One of my main interests is understanding the different features of Quantum Chaos and the development of a complete characterization of quantum complexity.

Research Interests

Topics of research I have been particularly interested in are the theory of quantum chaos and quantum complexity, magic of quantum states, theory of entanglement, quantum information in open systems, theory of topological order, theory of quantum integrability, quantum resource theory and coherence in quantum evolutions.

Education

Umass Boston

Ph.D., Applied Physics, Ongoing (Expected graduation date: May 2023)

- Written Qualifiers: *Passed*
- Oral Qualifier: *Passed*

University of Napoli Federico II, Naples, Italy

M.S., Theoretical Physics, July 2019

- Thesis Title: *Sinergy between the Heat kernel and the parity anomaly*
- Advisors: Professor Fedele Lizzi Professor Maxim Kurkov
- Final Mark: 110/110 cum laude

Teaching Experience

Fall 2019 - Fall 2020 Teaching Assistantship, Umass Boston

February 2015 - May 2018 Math and Physics tutor for high school and bachelor students.

References Available to Contact

Alioscia Hamma, Ph.D. (e-mail: alioscia.hamma@unina.it; Phone: +39 081-676495)
- Professor, Department of Physics
  University of Naples Federico II
  - ◇ 2N34, Complesso Universitario di Monte Sant'Angelo Complesso universitario di Monte Sant'Angelo - Via Cinthia - 80126 - Naples
  - ⋆ *Dr. Hamma is my Ph.D. advisor.*

Seth Lloyd, Ph.D. (e-mail: slloyd@mit.edu; Phone: +1 (617) 252 - 1803)
- Professor, Department of Mechanical Engineering
  Massachusetts Institute of Technology
  - ◇ 3-160, MIT 77 Massachusetts Avenue, Cambridge, Massachusetts 02139

Marco Cerezo, Ph.D. (e-mail: cerezo@lanl.gov;
- Staff Scientist, Los Alamos National Laboratories
  - ◇ Los Alamos National Laboratory, Los Alamos, NM 87545

Claudio Chamon, Ph.D. (e-mail: chamon@bu.edu; Phone: +1 (617) 353-5787)
- Professor, Department of Physics
  Boston University
  ◇ SCI, Room 319, BU 590 Commonwealth Avenue, Boston, MA 02215

Rahul Kulkarni, Ph.D. (e-mail: Rahul.Kulkarni@umb.edu; Phone: +1 (617) 287-5408)
- Professor, Department of Physics
  University of Massachusetts Boston
  ◇ W04-0046 , UMB 100 Morrissey Blvd., Boston, MA 02125

Awards

2022 - Quantum Computing Summer School Fellowship - LANL

Scholarships

- *Fall 2021* - College of Science and Mathematics Dean's Doctoral Research Fellowship through fellowship
- *Spring 2022* - College of Science and Mathematics Dean's Doctoral Research Fellowship through fellowship

Publications

1. Lorenzo Leone, Salvatore F.E. Oliviero, Alioscia Hamma
   Stabilizer Rényi entropy
   Physical Review Letters 128, 050402(2022)
2. Salvatore F.E. Oliviero, Lorenzo Leone, Alioscia Hamma and Seth Lloyd
   Measuring Magic on a quantum processor
   npj Quantum Information 8, 148 (2022)
3. Lorenzo Leone, Salvatore F.E. Oliviero, You Zhou, Alioscia Hamma
   Quantum Chaos is Quantum
   Quantum, volume 5, page 453 (2021)
4. Salvatore F.E. Oliviero, Lorenzo Leone, You Zhou, Alioscia Hamma
   Stability of topological purity under random local unitaries
   SciPost Phys. 12, 096 (2022)
5. Salvatore F.E. Oliviero, Lorenzo Leone, Alioscia Hamma
   Transitions in entanglement complexity in random quantum circuits by measurements
   Physics Letters A, 127721(2021)
6. Salvatore F.E. Oliviero, Lorenzo Leone, Francesco Caravelli,Alioscia Hamma
   Random Matrix Theory of the Isospectral Twirling
   SciPost Phys. 10, 076 (2021)
7. Lorenzo Leone, Salvatore F.E. Oliviero, Alioscia Hamma
   Isospectral twirling and quantum chaos
   Entropy 2021, 23(8), 1073(2021)
8. Salvatore F.E. Oliviero, Lorenzo Leone, Alioscia Hamma
   Magic-state resource theory for the ground state of the transverse field Ising model
   Physical Review A 106, 042426
9. Lorenzo Leone, Salvatore F.E. Oliviero, Stefano Piemontese, Sarah True, Alioscia Hamma
   Retrieving Information from a black hole using quantum machine learning
   Phys. Rev. A 106, 062434

10. Lorenzo Leone, Salvatore F.E. Oliviero, Alioscia Hamma
Nonstabilizerness determining the hardness of direct fidelity estimation
Accepted in Phys. Rev. A

11. Max Kurkov, Lorenzo Leone
Remark on the synergy between the heat kernel techniques and the parity anomaly
International Journal of Geometric Methods in Modern Physics, 17, 2050002-679(2020)

Preprints

12. Lorenzo Leone, Salvatore F.E. Oliviero, Seth Lloyd, Alioscia Hamma
Learning efficient decoders for quasi-chaotic quantum scramblers
https://doi.org/10.48550/arXiv.2212.11338

13. Salvatore F.E. Oliviero, Lorenzo Leone, Seth Lloyd, Alioscia Hamma
Black hole complexity, unscrambling and stabilizer thermal machines
https://doi.org/10.48550/arXiv.2212.11337

14. Lorenzo Leone, Salvatore F.E. Oliviero, Gianluca Esposito, Alioscia Hamma
Phase transition in Stabilizer Entropy and efficient purity estimation
https://doi.org/10.48550/arXiv.2302.07895

15. Lorenzo Leone, Salvatore F.E. Oliviero, Lukasz Cincio, Marco Cerezo
On the practical usefulness of the Hardware Efficient Ansatz
https://doi.org/10.48550/arXiv.2211.01477

Works in preparation

1. Lorenzo Leone, Salvatore F.E. Oliviero, Seth Lloyd, Alioscia Hamma
Learning efficient decoders for quasi-chaotic quantum scramblers

2. Salvatore F.E. Oliviero, Lorenzo Leone, Seth Lloyd, Alioscia Hamma
Black Hole complexity, unscrambling, and refrigeration

3. Francesco Caravelli, Salvatore F.E. Oliviero, Lorenzo Leone, Bin Yan, Zach Morell, Alioscia Hamma, Tameem Albash, Carleton Coffrin
Remarks on the emergence of Gibbs ensembles from quantum annealings

Oral and Poster Presentations

- "Stabilizer Rényi entropy", APS March Meeting, 17 March 2022, Oral Presentation
- "On the Practical Usefullness of Hardware Efficient Ansatz", QTML, November 2022, Poster Presentation
- "Emergence of Gibbs distribution in quasi-adiabatic regime", CNLS Los Alamos, Oral Presentation

Programming Skills

Mathematica, Matlab, Python, C, C++, LaTeX

Other Interests

Swimming, Running, Music.