Giovanni Scala

Curriculum Vitae

"Look up at the stars and not down at your feet.
Be curious." (S. Hawking)

Date of birth: 12/03/1993 |
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Bachelor (2015) and Master in Theoretical Physics (2017) both degrees obtained with the highest honours. Ph. D. in the QUANTUM Group at the University of Bari and scientific visitor at the University of Toruń. Independent Researcher at the International Center for Theories of Quantum Technologies (ICTQT) in Gdańsk. Post-doc at the University of Warsaw.

Research of interest

Quantum Foundations, Mathemathical Physics, Quantum Information.

Education

- **PhD in Theoretical Physics**, Università di Bari. XI.2017–XII.2020
  Title of project: *Quantum Correlations: from Foundations to Applications*

- **Master in Theoretical Physics**, Università di Bari, *110|110 cum Laude*. XI.2015–X.2017
  Title of thesis: *Quantum Correlation and Plenoptic Imaging*

- **Internship at INFN Sez. Bari**. II.2017–X.2017
  Topic of interest: *Correlation Plenoptic Imaging*

- **Bachelor in Physics**, University of Bari, *110|110 cum Laude*. IX.2012–VII.2015
  Title of thesis: *Evoluzione temporale di Sistemi Quantistici*

- **High School Diploma**, IISS "L.Di Maggio", S. Giovanni Rot. (Italy). IX.2007–VII.2012
  100|100, selected for the olympic games for Maths and Astronomy

Skills

- **Programming:** Wolfram Mathematica, Python, Matlab, JAVA, Assembly, C++.
- **Proofs of Theorems:** abilities to elaborate theorems in an abstract sense or to use, where possible, the auxiliary of the simulations (also based on Machine Learning and Parallelization Computing) to acquire hints for the analytical proof. As an example, in this way, I found my own XY-criterion, asymmetric effects in cavity QED, 8 points correlation function for predicting the signal-to-noise ratio in second-order interferometry scenario, and a no-go theorem for non-contextual ontological theory.
- **Languages:** Italian (mother tongue), English (fluent).
  Basic knowledge: Spanish, French.

Experience

- **Post-doc**, University of Warsaw, Warsaw. **01.07.2021; present**
  I am involved in the ultimate limits of quantum world.

- **Independent Research**, ICTQT, Gdańsk. **01.01.2021; 30.06.2021**
  I carried out researches aiming to prove no-go theorems based on the indiscernibles identity principle. There are physical theories that violated it, like quantum mechanics. I am also developing an original formalism for deriving new Bell's inequalities to better understand locality and realism assumptions.
- **Peer Reviewer**. **2020; present**
  I am a reviewer of international peer-review scientific journals in Physics and Mathematics.
- **Visiting PhD student**, University of Copernicus, Toruń, (Poland). **2018; 2020**
  I worked with prof. D. Chruściński prof. and G. Sarbicki on *Theory of Quantum Entanglement* and prof K. Słowik on *Light-Matter Interaction*.

- **Tutor for Physics**, University of Bari, Bari (Italy). **2018-19; 2019-20**
  Tutor for Bachelor students in Physics.

- **Tutor for Physics**, University of Bari, Bari (Italy). **2016-17; 2018-19**
  Tutor for Physics exam at the Department of Biotechnology.
- **Assistant**, University of Foggia, S. Giovanni Rot. (Italy). **from 2015 to 2020**
  assistant to the Physics exam at the Department of Medical Science.

List of invited Project

- **Prom Project**, N. Copernicus University, Toruń, The international exchange of Ph.D. students. **18.I.2020–15.II.2020**
  I won this intership which has strenghtened my collaboration with the Mathematical Physics group and with the Quantum Optics group in Toruń.
- **TAPS (The Toruń Astrophysics / Physics Summer Program)**, University of Toruń, Toruń. **VIII.2018**
  I won this intership to attend the project "Light interactions to asymmetric quantum systems"

Publications

- G. Sarbicki, **G. Scala**, D. Chruściński, "Detection power of separability criteria based on a correlation tensor: a case study", (accepted 08 July, 2021 *OSID*)
  `https://arxiv.org/abs/2012.04359`

- **G. Scala**, F. V. Pepe, K. Słowik, P. Facchi, S. Pascazio, "Beyond the Rabi model: light interactions with polar atomic systems in a cavity", (accepted 09 July, 2021 *Phys. Rev. A*)
  `https://arxiv.org/abs/2103.11232`
- **G. Scala**, F. V. Pepe, P. Facchi, S. Pascazio, K. Słowik, "Light interaction with extended quantum systems in dispersive media", *New Journal Physics* (December 30, 2020) 22, 123047
  `https://doi.org/10.1088/1367-2630/abd204`

- G. Sarbicki, **G. Scala**, D. Chruściński, "Enhanced realignment criterion vs. linear entanglement witnesses", *J. Phys. A: Math. Theor* (October 21, 2020) 53, 455302
  `https://doi.org/10.1088/1751-8121/abba46`

- G. Sarbicki, **G. Scala**, D. Chruściński, "A family of multipartite separability criteria based on correlation tensor", *Phys. Rev. A* (January 27, 2020) 101, 012341.
  `https://doi.org/10.1103/PhysRevA.101.012341`

- **G. Scala**, G. Massaro, M. D'Angelo, A. Garuccio, S. Pascazio, F. V. Pepe, "Signal-to-noise ratio in correlation plenoptic imaging", *Proc. SPIE 11347, Quantum Technologies* (April 14, 2020), 1134713,
  `https://doi.org/10.1117/12.2555701`

- **G. Scala**, M. D'Angelo, A. Garuccio, S. Pascazio, F. V. Pepe, "Signal-to-noise properties of correlation plenoptic imaging with chaotic light", *Phys. Rev. A* (May 7, 2019) 99, 053808
  `https://doi.org/10.1103/PhysRevA.99.053808`

- **G. Scala**, "Two-Level Systems with Broken Inversion Symmetry", Proceedings (November 20, 2019), 12, 49,
  `https://doi.org/10.3390/proceedings2019012049`

Preprints

- F. V. Pepe, G. Chilleri, **G. Scala**, D. Triggiani, Y. Kims, V. Tamma, "Distance sensing with remote double slits", (submitted)
  `https://arxiv.org/abs/2011.05224`

An updated list of publications can be found on my ArXiV and on my homepage.

Partial List of Open Projects

- M. Żukowski, M. Karczewski, G. Scala, A. Mandarino, A. B. Sainz, *New way of deriving Bell inequalities*, (private communication, work in progress)
- L. Catani, G. Scala, M. Leifer *Contextuality captures wave-particle duality*, (private communication, work in progress).
- Anubhav Chaturvedi, P. Cavalcanti, S. Rout, G. Scala *Information causality and ϵ–Contextuality* (private communication, work in progress).
- G. Scala, A. Bera, G. Sarbicki, D. Chruściński, *Optimal multipartite linear entanglement witnesses*, (private communication, work in progress)
- G. Scala, *Analysis of folia and local quantum field theory*, (private communication, work in regress)
- G. Scala, G. Sarbicki, D. Chruściński, *Geometrical interpretation of entanglement witnesses and positive maps*, (private communication, work in progress)
- G. Scala, G. Massaro, M. D'Angelo, F. V. Pepe, *Comparison between CPI and CPM*, (private communication, work in progress).

Academic background

My researches began with three main topics. Optical coherence at second-order for interferometry. Theory of light-matter interactions in cavities. Entanglement detection with my separability criterion. Currently, I am focused on Contextuality in Quantum Foundations and convex optimization problems. Overall, my academic career is an effort to be more familiar with the underlying structure of quantum phenomena trying to implement underpinning interpretations of physical manifestations.

About Me

Quick learner, hard worker, ambitious with a strong passion for Physics, Astrophilia, Literature, and Philosophy. Always looking for ways to broaden my knowledge. Since the high-school founder of cultural associations. An easygoing person that loves to meet people from various cultural backgrounds.