

## PERSONAL INFORMATION

Giacomo Zuccarini

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Sex Male | Nationality Italian

## POSITION

Post-doctoral research fellow. Department of Physics, University of Pavia.  
<https://fisica.unipv.it/personale/Persona.php?ID=549>

## WORK EXPERIENCE

- 2020, September – ongoing **Post-doctoral research fellow in Physics Education**  
Design and validation of teaching/learning sequences on quantum physics, non-classical logic, quantum computing and communication for secondary school and university students.
- 2023, September, 4-8 **Organization and management of Summer Schools**  
Summer school “Quantum Technologies”. University of Pavia, 2<sup>nd</sup> edition.  
2022, September, 5-9 Summer school “Quantum Technologies”. University of Pavia, 1<sup>st</sup> edition.
- 2023, September, 4-8 **University Teacher**  
Summer school “Quantum Technologies”. University of Pavia, 2<sup>nd</sup> edition.  
2022, September, 5-9 Summer school “Quantum Technologies”. University of Pavia, 1<sup>st</sup> edition.
- 2022, April Seminar “Quantum Mechanics Education: The Spins-First Approach” (4h) within the “Physics Education” course. Department of Physics, University of Pavia.
- 2015, March University, of Verona, Computer Science Department, Course of quantum mechanics. Related paper: Building the Basics Concepts of Quantum Mechanics with Math and Computer Science Students.
- 2023, May, 17 **University Teaching Consultant**  
Seminar for the Department of Physics and Geology. University of Perugia.  
“Concetti quantistici e concezioni quantizzate” University Student Understanding of Quantum Mechanics and Validated Tutorials for Promoting Learning.
- 2014, March, 18 Seminar for the Physics Department. University of Linz (Austria). University Student Understanding of Quantum Mechanics.
- 2014, February, 25 Seminar for the Physics Department. Roma Tre University. University Student Understanding of Quantum Mechanics.
- 2014, January, 8 Seminar for the Physics Department. Technische Universität, Dresden (Germany). University Student Understanding of Quantum Mechanics.
- 2020, October - 2022, June **Secondary School Teacher Educator**  
Course for secondary school in-service teachers, “Piano lauree scientifiche” (PLS). Course of quantum mechanics, non-classical logic, quantum computing and communication. University of Pavia.

- 2019, January, 30 Course for in-service teachers, "Liceo Alessi" High School, Perugia (PG);  
February, 15 Mathematics in physics: its role and effective use in teaching; Quantum mechanics
- 2018, December 4-13 Course for in-service teachers, "Liceo Corradini" High School, Thiene (VI);  
Mathematics in physics: its role and its effective use in teaching, quantum mechanics
- 2018, July 23-28 National School of Modern Physics for Secondary School Teachers (SNI-  
2017, September 4-9 FM2018, PLS; SNI-FM2017, PLS; SNI-FM2014, PLS). University of Udine.  
2014, September 8-12 Course: curricular materials and educational strategies for the teaching of  
quantum mechanics. Seminar on the history of science: birth and development of  
the concept of light quanta.
- 2016, February 8-13 Course for in-service teachers, "Liceo Alessi" High School, Perugia:  
"Physics by inquiry for teaching quantum mechanics in the secondary school"
- 2015, February 16 Seminar for pre-service teachers, University of Camerino. History of science: birth  
and development of the concept of light-quanta.
- Secondary School Teacher**
- 2023, January-April "Percorsi per le competenze trasversali e l'orientamento", "A come abaco, Q  
come Quanto", "Liceo Alessi", High School", Perugia, Quantum Info Sciences
- 2021, April "Percorsi per le competenze trasversali e l'orientamento" (PCTO) on quantum  
technologies." in distance learning
- 2020, November – "Liceo Galilei", High School, Voghera (PV). Course of quantum mechanics, logic,  
2021 June computing, and information
- 2019, March 25-30 "Liceo Galilei", High School, Trieste; Course of quantum mechanics
- 2019, January 30 "Liceo Alessi", High School, Perugia; Course of quantum mechanics  
February 15
- 2018, December 4-13 "Liceo Corradini" Thiene (VI); Course of quantum mechanics
- June 25-30, 2018 Summer School of Excellence on Modern Physics for Secondary School  
June 26-July 1, 2017 Students (SENS-FM2018, SENS-FM2017, SENS-FM2016, SENS-FM2015,  
June 27-July 2., 2016 SENS-FM2014, SENS-FM2013), Department of Computer science, Mathematics  
July 13-18, 2015 and Physics (Formerly: Department of Chemistry, Physics and Environment),  
June 23-27, 2014 University of Udine  
July 22-27, 2013 Subjects: Teaching/learning sequence on the introduction of quantum mechanics,  
light diffraction experiment, Malus' law experiment
- 2016, January-June Physics Teacher, "I.S.I.S. B. Stringher" High School, Udine.
- 2016, January "Liceo Galilei" High School, Trieste; Course of quantum mechanics
- 2016, February "Liceo Alessi" High School, Perugia; Course of quantum mechanics

## EDUCATION AND TRAINING

- 2018, July, 23 Ph.D. in Mathematics and Physics  
Department of Computer science, Mathematics and Physics, University of Udine,  
Thesis: Relations between Observables and Student Understanding of Quantum Mechanics
- August 24-29, 2014 European Science Education Research Association (ESERA) Summer school for Ph.D. Students, Kapadokya, Turkey
- 2012, April, 26 M.D. in Physics (grade: **110/110 cum laude**)  
Sapienza University of Rome, Italy  
Thesis: Learning Quantum Mechanics at University Level

## PERSONAL SKILLS

Mother tongue(s)  
Other language(s)

Italian

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	B2	B2	C1
German	B2	B2	B2	B2	B1
Spanish	B1	B1	B1	B1	A2

### Communication skills

- experience in international conference talks and seminars series given during the Ph.D. Program
- intercultural skills: gained through collaboration with TU Dresden Research Unit on Physics Education during an ERASMUS STUDIO Program of 4 months in Dresden (Germany)

### Computer skills

- “Excel”; “Word”; “LaTeX”; “Power Point”; “MAXQDA 11” (mixed method and qualitative data analysis)

## COMPLETE PUBLICATION LIST

Articles in published in journals, edited books, conference proceedings, or in peer review

Zuccarini, G., & Michelini, M. (2023). Promoting the transition to quantum thinking: development of a secondary school course for addressing knowledge revision, fragmentation and epistemological challenges. In peer-review. arXiv: [2301.00239](https://arxiv.org/abs/2301.00239).

Zuccarini, G., Malgieri, M., Sutrin, C., & Macchiavella, C (2023). Elementarizing quantum algorithms: clarification of the internal structure and preliminary learning outcomes. In peer review.

Sutrin, C., Malgieri, M., Zuccarini, G., Macchiavella, C. (2023). A teacher professional development course on quantum technologies: discussion of results. J. Phys.: Conf. Ser.: 2490 012006. DOI: [10.1088/1742-6596/2490/1/012006](https://doi.org/10.1088/1742-6596/2490/1/012006).

Zuccarini, G., & Malgieri, M. (2022). Modeling and Representing Conceptual Change in the Learning of Successive Theories: The Case of the Classical-Quantum Transition. Science & Education. DOI: [10.1007/s11191-022-00397-1](https://doi.org/10.1007/s11191-022-00397-1)

Bondani, M., Chiofalo M. L., Ercolessi, E., Macchiavello, C., Mishina, O., Onorato, P., Pallotta, F., Satanassi, S., Stefanel, A., Suttrini, C., Testa, I., & Zuccarini G. (2022). Introducing quantum technologies at secondary school level: challenges and potential impact of an on-line extracurricular course. *Physics* 2022, 4(4), 1150-1167. DOI: [10.3390/physics4040075](https://doi.org/10.3390/physics4040075)

Suttrini, C., Zuccarini, G., Malgieri, M., & Macchiavello, C. (2022). A possible role of the second quantum revolution in physics education, in *Proceedings of ESERA 2021 Conference*, pp. 438-445. URL: <https://www.esera.org/wp-content/uploads/2023/02/CNF21-Complete-eProceedings.pdf>

Malgieri, M., Zuccarini, G., & Onorato, P. (2022). Approximate time-energy uncertainty relationship from the fixed energy sum over paths approach. *Canadian Journal of Physics*, 100(8). DOI: [10.1139/cjp-2021-0084](https://doi.org/10.1139/cjp-2021-0084)

Pospiech, G., Merzel, A., Zuccarini, G., Weissman, E., Katz, G., Galili, I., Santi, L., & Michelini, M. (2021). The role of mathematics in teaching quantum physics at high school. In Jarosievitz, B. & Sükösd, C. (Eds.) *Teaching-learning contemporary physics, from research to practice* (pp. 47-70). Springer. DOI: [10.1007/978-3-030-78720-2\\_4](https://doi.org/10.1007/978-3-030-78720-2_4)

Malgieri, M., Calcagnile, S., Zuccarini, G., & Onorato, P. (2021). High school student difficulties in drawing the field lines for two magnets. *Physics Education*, 56(6), 1-13. DOI: [10.1088/1361-6552/ac1a06](https://doi.org/10.1088/1361-6552/ac1a06)

Zuccarini, G. (2020) Analyzing the structure of basic quantum knowledge for instruction. *American Journal of Physics* 88, 385; DOI: [10.1119/10.0000835](https://doi.org/10.1119/10.0000835)

Michelini, M., Monti, F., Santi, L., & Zuccarini, G. (2017). Building the Basic Concepts of Quantum Mechanics with Math and Computer Science Students. In T. Greczyło, E. Dębowska (Eds.), *Key Competencies in Physics Teaching and Learning*, (pp. 117-127). Springer, Wrocław, Poland; DOI: [10.1007/978-3-319-44887-9\\_10](https://doi.org/10.1007/978-3-319-44887-9_10)

Michelini, M. & Zuccarini, G. (2014). University students' reasoning on physical information encoded in quantum state at a point in time, in *Proceedings of PERC 2014*, Minneapolis, USA. DOI: [10.1119/perc.2014.pr.043](https://doi.org/10.1119/perc.2014.pr.043)

Zuccarini, G. (2014). Physics student ideas on quantum state and its formal representations, *Il Nuovo Cimento C*, 37(4), 273; DOI: [10.1393/ncc/i2014-11811-6](https://doi.org/10.1393/ncc/i2014-11811-6)

Zuccarini, G., & Michelini, M. (2014). Investigating Student Ideas on the Connection Between Formal Structures and Conceptual Aspects in Quantum Mechanics, in *Proceedings of GIREP-MPTL 2014*, Palermo, Italy, pp. 523-530. URL: <http://www1.unipa.it/girep2014/img/proceedings.png>

Zuccarini, G., Michelini, M., & Stefanel, A. (2013). Questioning with university students on stationarity, time evolution and connection between sets of eigenstates in quantum mechanics, in *Proceedings of ESERA 2013*, Nicosia, Cyprus, pp. 204-214. URL: <https://www.esera.org/publications/esera-conference-proceedings/esera-2013>

Zuccarini, G., Michelini, M., & Stefanel, A. (2013). University students' ideas on physical meaning and role of wavefunction and state vector in quantum physics, in Proceedings of ICPE 2013, Prague, Czech Republic, pp. 258-266. URL: [http://iupap-icpe.org/publications/proceedings/ICPE-EPEC\\_2013\\_proceedings.pdf](http://iupap-icpe.org/publications/proceedings/ICPE-EPEC_2013_proceedings.pdf)

Michelini, M., Stefanel, A., & Zuccarini, G. (2013), Exploring university student ideas on the relationship between formal aspects and physical meanings in quantum mechanics, in Proceedings of APLIMAT 2013, Bratislava, Slovak Republic, pp. 435-446. URL: <https://www.scopus.com/record/display.uri?eid=2-s2.0-84902669962&origin=inward&txGid=c22565e17a5d407eec87018557b10d6b>

Michelini, M., Stefanel, A., & Zuccarini, G. (2012). The complex nature of quantum wavefunction and state vector: analysis of case studies on 3rd year Italian physics students, in Proceedings of the World Conference in Physics Education 2012, Istanbul, Turkey, pp. 1095–1102. URL: [http://iupap-icpe.org/publications/proceedings/WCPE2012\\_proceedings.pdf](http://iupap-icpe.org/publications/proceedings/WCPE2012_proceedings.pdf)

## ADDITIONAL SCIENTIFIC ACTIVITIES

### Presentations at conferences

- 2023 ESERA Conference, Cappadocia, Turkey: "The cognitive side of conceptual change in the learning of successive theories"; "Theoretical inquiry for learning quantum mechanics: operationalizing thought experiments"
- 2022 GIREP Conference, Ljubljana, Slovenia: "Elementarizing quantum algorithms: clarification of the internal structure and preliminary learning outcomes"
- 2021 ESERA Virtual Conference, Braga, Portugal, "Modeling and representing conceptual change in the transition from classical to quantum mechanics"
- 2019 GIREP-ICPE-EPEC-MPTL, Budapest, Hungary: "Analyzing basic quantum knowledge for instruction"; "Interplay between math and physics in an educational path on quantum mechanics in secondary school"
- 2015 ESERA Conference, Helsinki, Finland: "University students on the role of incompatibility in quantum mechanics"
- 2014 Congress of the Italian Association for Physics Teaching (AIF), Perugia, Italy: "Costruzione dei concetti base della meccanica quantistica nei contesti della polarizzazione e dello spin"
- 2014 Congress of the Italian Physical Society (SIF), Pisa, Italy: "Il ruolo dell'incompatibilità nella descrizione dei processi quantomeccanici e nella strutturazione formale della teoria: un'indagine su studenti di fisica del 3° anno"
- 2014 PERC, Minneapolis, US: "University students' reasoning on physical information encoded in quantum state at a point in time"
- 2014 AAPT Conference, Minneapolis, US: "Building quantum mechanics basic concepts in the contexts of polarization and spin"
- 2014 GIREP-MPTL Conference, Palermo, Italy: "Investigating Student Ideas on the Connection Between Formal Structures and Conceptual Aspects in Quantum Mechanics"
- 2013 Congress of the Italian Physical Society (SIF), Trieste, Italy: "Connessioni tra significato fisico dello stato quantistico e sue rappresentazioni formali: un'indagine su studenti di fisica del 3° anno"
- 2013 ESERA Conference, Nicosia, Cyprus: "Questioning with university students on stationarity, time evolution and connection between sets of eigenstates in quantum mechanics"
- 2013 ICPE-EPEC Conference, Prague, Czech Republic: "University students' ideas on

physical meaning and role of wavefunction and state vector in quantum physics”

2013 APLIMAT Conference, Bratislava, Slovak Republic: Exploring university student ideas on the relationship between formal aspects and physical meanings in quantum mechanics”

2012 WCPE, Istanbul, Turkey: “The complex nature of quantum wavefunction and state vector: analysis of case studies on 3rd year Italian physics students”

#### Honours and awards

- 1<sup>st</sup> Prize Best Communication Award at the National Congress of the Italian Physical Society (SIF), 2013. Section 6: “Fisica generale, didattica e storia della fisica”  
<https://www.sif.it/attivita/congresso/xix/comunicazioni>
- PERLOC Conference Travel Grant (AAPT-PERC), USA, 2014

#### Academic visiting

ERASMUS STUDIO program at the Technische Universität, Dresden (Germany) from November 2013 to end February 2014 (4 months)

#### Internationally based activities

Quantum Technology Education Community  
[https://docs.google.com/presentation/d/175ai-r-jBn4ZM9bV9JElrwQA3GYdBdlk7KOMuEUDVE4/edit#slide=id.gc155ec22ec\\_171\\_0](https://docs.google.com/presentation/d/175ai-r-jBn4ZM9bV9JElrwQA3GYdBdlk7KOMuEUDVE4/edit#slide=id.gc155ec22ec_171_0)