

Sebastiano Pilati

CURRICULUM VITAE

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Scientific qualification: "ASN 02/B2, fisica teorica della materia, fascia II"

CURRENT RESEARCH POSITION

- 02/2020 – ongoing: Temporary Assistant Professor (RTDB), University of Camerino
via Madonna delle Carceri 9, I-62032 Camerino (MC), Italy

PREVIOUS RESEARCH POSITIONS:

- 12/2017 – 01/2020: Temporary Assistant Professor (RTDA) University of Camerino
- 01/2017 – 11/2017: Research fellow (assegnista di ricerca), University of Padova
- 09/2011 – 12/2016: Ludwig Boltzmann Fellow (senior PostDoc), ICTP (Trieste, Italy)
- 09/2009 – 08/2011: Postdoctoral Fellow, ETH – Swiss Federal Institute of Technology, Zurich
- 04/2008 – 08/2009: Postdoctoral Fellow, INO-CNR "BEC Centre" - Trento (Italy)

FURTHER RESEARCH EXPERIENCES:

- 09/2004 – 08/2005: Visiting Graduate Student
Group of Prof. [REDACTED], Polytechnic University of Catalunya, Barcelona (Spain).
- 03/2004 – 09/2004: Post-Lauream Fellowship
INFN - Istituto Nazionale di Fisica della Materia, Unità di Ricerca di Trento

EDUCATION:

- 08/2004 – 02/2008: Ph.D. Degree in Physics at the University of Trento
Title: "*Studies of Ultracold Gases using Quantum Monte Carlo techniques*"
Supervisor: Prof. [REDACTED] Evaluation: excellent.
- 02/2004: Laurea in Physics at the University of Trento (18/02/2004)
Title: "*Quantum Monte Carlo study of the ground-state properties of a two dimensional Bose gas*"
Evaluation: 110/110 cum Laude Average exams grade: 29.67/30

MY RESEARCH PROFILE

I'm a computational physicist with expertise in ultracold atomic gases, in adiabatic quantum computing, and in machine learning methods. My work focuses on the development of novel computer simulation methods for quantum many-body systems based on quantum Monte Carlo algorithms, on machine learning techniques, and on the use of high-performance computers. The long-term goal of my research is to improve the theoretical and computational techniques for quantum many-body systems beyond the state-of-the-art and to guide the engineering of novel phases of coherent quantum matter and of novel quantum technologies. I'm also interested in the development of quantum-enhanced optimization methods for complex optimization problems relevant for industry, and in the use of machine learning methods in diverse fields, including, e.g., protein-ligand binding for drug design, search-engines for booking websites, and communication network protocols.

SUPERVISION OF STUDENTS/POST-DOCTORAL FELLOWS:

- Supervisor of 1 PhD student at SISSA (graduated, currently holding the Francis Kofi Allotey fellowship at Perimeter Institute).

- Currently supervisor of 2 PhD students of the PhD Program in Quantum Technologies (UniNa, UniCam, INO-CNR Florence).
- Currently supervisor of 1 PhD student at UniCam.
- Supervisor of 1 Master student (tesi di laurea magistrale in fisica) at UniCam.
- Supervisor of 2 bachelor students (tesi di laurea Triennale in fisica).
- Supervisor of 6 students of the Postgraduate Diploma Program in Condensed Matter Physics at ICTP (Trieste).
- Co-supervisor of 1 Master Student of the Master in High Performance Computing (SISSA-ICTP, Trieste).
- Advisor of 2 Junior Postdoctoral fellows at ICTP (Trieste).
- Advisor of 2 Postdoctoral fellows (assegnista di ricerca) at UniCam.
- Supervisor of 2 fellowship projects for the UniCam-6trour.com collaboration on machine learning.
- Referee and external jury member of 2 PhD theses in SISSA (Trieste), and 1 PhD thesis at EPFL (Lausanne).
- Supervisor for semester projects and physics pro-seminars at ETHZ (2009-2011).

ORGANIZATION OF ACTIVITIES (Conferences, Workshops, Schools, Seminar Series):

- Conference on “Frontiers in Two-Dimensional Quantum Systems”, 13-17 November 2017, Trieste <http://indico.ictp.it/event/8006/>.
- Workshop on “Understanding quantum phenomena with Path Integrals: from Chemical Systems to Quantum Fluid and Solids”, 3-7 July 2017 – Trieste <http://indico.ictp.it/event/7975/>.
- Workshop “Theory and Practice of Adiabatic Quantum Computers and Quantum Simulation”, 22-26 August 2016 – Trieste <http://indico.ictp.it/event/7607/>.
- Summer School “Computational Condensed Matter Physics: from Atomistic Simulations to Universal Model Hamiltonians”, 7-25 September 2015 – Trieste <http://indico.ictp.it/event/a14246/>.
- Workshop “Probing and understanding exotic superconductors and superfluids”, 27-31 October 2014 – Trieste <https://exs2014.wordpress.com/>.
- Weakly Seminar Series on “Disorder and Strong Electron Correlations” at ICTP, 2012-2104.
- Bi-weakly Seminar Series on “Condensed Matter and Statistical Physics” at ICTP, since 01/2016.
- Session on “Ultracold Atoms and Photonics” of the XCIX Congress of the Italian Physical Society in 2013, 23 – 27 September, Trieste <https://www.sif.it/attivita/congresso/xcix>
- Co-organizer of the XXIV Congress of the Italian National Institute of Matter Physics, 17-20 September 2006, Levico.

THIRD PARTY FUNDING:

- PRIN2017 project “CEnTraL” (PI of the UniCam Research Unit) 36 months, unit budget: 123 K€.
- PI of the FAR2018 Unicam project entitled “*Supervised machine learning for quantum matter and computational docking*”, 24 months, budget 51 K€.
- PI of the ISCRA Class C project entitled “*Machine Learning for Disordered Quantum Systems*” (IsC78 HP10CZATC4), involving an allocation of 60000cpu/hours, officially corresponding to 750€.
- PI of the ISCRA Class C project entitled “*Scalable Neural Networks for Quantum Systems*” (IsC70 HP10COYYWP), involving an allocation of 228480cpu/hours.
- PI of the ISCRA Class C project entitled “*Combining Quantum Monte Carlo Simulations with Machine Learning Techniques*” (IsC63 HP10C59ASO), involving an allocation of 326000cpu/hours, officially corresponding to 2040€.
- PI of the ISCRA Class C project entitled “*Simulation of Complex Quantum Systems*” (IsC55 HP10CTITUQ), involving an allocation of 360000cpu/hours, officially corresponding to 2250€.
- With co-organizers, we were awarded the “Junior Block Travel Award”, worth 6000\$, from the international institute ICAM, as contribution for the Workshop “*Probing and understanding exotic superconductors and superfluids*”, 27-31 October 2014.
- With co-organizers, we were awarded the “General Workshop Award”, worth 10000\$, from the international institute ICAM, as contribution for the Workshop “*Theory and Practice of Adiabatic Quantum Computers and Quantum Simulation*”, 22-26 August 2016 – Trieste.

- With co-organizers, we were awarded 7000\$ from the Psi-k network to organize the workshop on “*Understanding quantum phenomena with Path Integrals: from Chemical Systems to Quantum Fluid and Solids*”.

TEACHING:

- “Calcolo numerico e Programmazione”, 60h, Laurea Triennale in Fisica, Università di Camerino (AY 2020-2021)
- “Fisica Generale II”, 25h, Laurea Triennale in Matematica (AY 2019-2021).
- “Calcolo numerico e Programmazione”, 72h, Laurea Triennale in Fisica, Università di Camerino (AYs 2017-2020).
- “Fisica Statistica”, 8h, Laurea Triennale in Fisica, Università di Camerino (AYs 2018-2020).
- “Machine Learning and its applications”, 14h, AY 2020-2021, PhD in Science and Technology (UniCam).
- “Introduction to Machine Learning”, 8h, AY 2018-2020, PhD in Science and Technology (UniCam).
- Member of the Doctoral School Committee for the PhD program in “*Quantum Technologies*” (UniNA, UniCAM, INO-CNR), 2018-2021
- Master in High Performance Computing, module on “Monte Carlo Methods”, SISSA-ICTP – Trieste, years 2014-2016.
- “Numerical Methods I”, part of the Graduate Diploma Programs in “Condensed Matter Physics” and “Earth System Physics” at ICTP, and for the “International Master in Complex Systems” (Laurea magistrale, SISSA, Politecnico di Torino, Paris 6-7-11 and École Normale Supérieure), years 2012-2016.
- “Numerical and Monte Carlo methods”, 18h, Ph.D. Program in Statistical Physics, SISSA (Trieste), years 2011-2016.
- “Numerical Methods II”, in the Graduate Diploma Program in Condensed Matter Physics at ICTP, 2011-2015.
- Tutor during the ICTP Summer School on “Quantum Many-Body Physics of Ultracold Atoms and Molecules”, 2-13 July 2013, Trieste (Italy).
- Lectures in the course “Computational Quantum Physics” by Prof. M. Troyer at ETHZ in 2009-2011.
- Teaching assistant for the course on electromagnetism (UniTN, AY 2006/2007).

REFEREEING:

- Physical Review Letters, Physical Review B, Physical Review A (published by the American Physical Society).
- The New Journal of Physics, Journal of Physics A: Mathematical and Theoretical and Journal of Physics B: Atomic, Molecular & Optical Physics (published by the Institute of Physics).
- The European Physical Journal (published by EDP Sciences, Società Italiana di Fisica and Springer).
- Journal of Statistical Mechanics: theory and experiment (published by IOP and SISSA).
- IEEE Access.
- Scientific Reports (Nature Publishing Group).
- AIP Advances.

INVITED TALKS:

- SuperFluctuations 2021 - Fluctuations and Highly Non-Linear Phenomena in Superfluids and Superconductors, 14-16 June 2021 (online).
- SuperFluctuations 2020 - Fluctuations and Highly Non-Linear Phenomena in Superfluids and Superconductors, 22-23 June 2021 (online).
- Summer school 2019 of the PhD Program in Quantum Technologies (UniNA, UniCAM, CNR-INO/LENS), 15-21 September 2019, Ischia (Italy).
- Superfluctuations 2019, Fluctuations and Highly Non-Linear Phenomena in Superfluids and Superconductors, 2-4 September 2019, Padova (Italy).
- Machine Learning for Quantum Design, 9-12 July 2019, Waterloo (Canada).
- Quasiperiodicity and Fractality in Quantum Statistical Physics, New Brunswick (USA), 20-23 May, 2019.
- SuperFluctuations 2018, Fluctuations and Highly Non-Linear Phenomena in Superfluids and Superconductors, San Benedetto del Tronto (Italy), 5-7 September (2018).
- Superfluctuations 2017, San Benedetto del Tronto (Italy), 6-8 September 2017.
- IX Brazilian Meeting on Simulational Physics (BMSP), Natal (Brazil), 21-25 August 2017.
- Many-body Physics in Synthetic Quantum Systems, Stellenbosch, South Africa, 4-8 April 2016.

- XVIII International Conference on Recent Progress in Many-Body Theories, 16-21 August 2015.
- Multisuper 2014. International Conference on “Multicondensate Superconductivity and Superfluidity in Solids and Ultracold Gases”, 24-27 June 2014, Camerino (Italy).
- Workshop “Correlation in Ultracold Atomic Gases”, 26-27 September 2013, Padova (Italy).
- Conference “Quantum Technologies IV”, 15-20 September 2013, Warsaw (Poland).
- INT Program “Advances in QMC techniques”, 24 June -2 August 2013, Seattle (USA).
- CECAM Workshop on “Modeling Materials with Cold Gases Through Simulations”, 9-11 November 2011, Zurich (Switzerland).
- Workshop “Correlations in Quantum Gases”, 30 September-2 October 2010, Menorca (Spain).
- International Workshop: “Theory of Quantum Gases and Quantum Coherence” 2-4 June 2010, Nice.
- Workshop on Quantum Monte Carlo techniques, 29 November 2008, Sardinia (Italy).

SEMINARS AT UNIVERSITIES AND RESEARCH INSTITUTES:

- *Boosting classical and quantum Monte Carlo simulations using generative neural networks*, HSE Tikhonov Moscow Institute of Electronics and Mathematics (Russia), 22 April 2021 (on-line).
- *Supervised machine learning for ultracold atoms in speckle disorder*, University of Barcelona (Spain), 8 May 2019.
- *Quantum enhanced optimization and machine learning*, Università di Napoli Federico II (Italy), 8 February 2019.
- *Simulated quantum annealing via projective quantum Monte Carlo algorithms*, Los Alamos National Laboratory (USA), 19 June 2018.
- *Projective Quantum Monte Carlo Simulations of Ultracold Fermi Gases and adiabatic quantum computers*, Polytechnic University of Catalunya (Spain), 23 February 2018.
- *Localization in disordered atomic Fermi gases*, University of Barcelona (Spain), 21 February 2018.
- *Simulated quantum annealing via Quantum Monte Carlo methods*, University of Padova (Italy) - Villa Bolasco, Castelfranco, 13 luglio 2017.
- *Disorder and interactions in ultracold Fermi gases*, University of Camerino (Italy), 8 February 2017.
- *Ultracold Fermi gases in periodic and in disordered potentials*, LPMMC, Grenoble (France), 17 June 2016.
- *Disorder and interactions in ultracold Fermi gases*, INLN Nice (France), 25 November 2016.
- *Ultracold atoms in optical lattices: beyond the Hubbard model*, ICTP, Trieste (Italy), 26 April 2012.
- *Ultracold atoms in optical lattices: beyond the Hubbard model*, University of Trento (Italy), 4 April 2012.
- Polytechnic University of Catalunya (Spain), 19 January 2012.
- Many-body physics with atomic gases in optical lattices, ICTP, Trieste (Italy), 15 February 2011.
- Quantum Monte Carlo studies of ultracold gases, ETH Zurich (Switzerland), 24 April 2008.
- Phase Separation in a polarized Fermi gas at zero temperature, University of Trento (Italy), 12 February 2008.

TALKS GIVEN AT REVIEW MEETINGS:

- DARPA Review meeting, Optical Lattice Emulator project, 20-24 June 2011, Vail (Colorado-USA).
- DARPA Review meeting, Optical Lattice Emulator project, 23-25 May 2010 Houston (Texas-USA).
- QSIT Meeting, 27-29 January 2010, Arosa (Switzerland).
- Joint Trento-Innsbruck Meeting, 30 November 2007, Innsbruck (Austria).

COMPUTER/PROGRAMMING SKILLS:

- Programming in Python, C/C++, Fortran90, Bash scripts.
- Machine learning: deep/convolutional/autoregressive neural networks, Boltzmann machines (python scikit-learn library, Keras).
- Parallel Programming (OPENMP).
- Use of modern libraries of Linear Algebra Computations (PLASMA, Lapack, MKL).
- Microsoft Office (Word, Excel, PowerPoint), OpenOffice, Xmgrace, Gnuplot.
- Versioning and revision control systems (Github, SVN, Vistrails).

LANGUAGE SKILLS: fluent in Italian, English and Spanish, basic knowledge of German (level A2.1 of CEFR).

BIBLIOGRAPHIC DATA

Published Articles: 39

1 in Nature Physics, 8 in Physical Review Letters, 1 in SciPost Physics, 1 in Scientific Reports, 5 in Physical Review B, 2 in New Journal of Physics, 12 in Physical Review A, 1 in Journal of Statistical Mechanics: Theory and Experiment, 5 in Physical Review E, 1 in The European Physical Journal B, 1 in Condensed Matter Theories [Proceedings Paper], 1 in Italian Journal of Educational Research.

Citations according to ISI - Web of Science (Thomson Reuters)

Sum of the Times Cited: 796

h-index (Web of Science): 15

