

# Curriculum Vitae

## Dr. Francesco Piazza

Date and birthplace: January 28, 1983,  
Castel San Pietro Terme (BO), Italy

Citizenship: Italian

Knowledge of foreign languages: English and German, fluent in written and spoken language

Work address: Max-Planck Institute for the Physics of Complex Systems  
Nöthnitzer Straße 38, 01187 Dresden, Germany

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### Research Interests

Many-Body Quantum Optics:

- Strongly correlated quantum light-matter systems
- Non-equilibrium collective phenomena in driven/dissipative systems

Quantum Metrology:

- Enhanced sensing in Cavity QED
- Sub-shot-noise sensitivity and entanglement

Superfluidity:

- Critical velocity
- Josephson effects

Quantum Criticality in Strongly Correlated Fermionic Systems

### Academic career:

2017-: Research Group Leader  
Host: Max-Planck Institute for the Physics of Complex Systems (Dresden)

2015-2017: APART research fellow at the University of Innsbruck  
Host: Prof. H. Ritsch, Institute of Theoretical Physics

2013-2014: Post-doc at the TU Munich. Group of Prof. W. Zwerger

2011-2013: Alexander Von Humboldt Fellow. Host: Prof. W. Zwerger, TU Munich

2007-2011: Ph.D. in Physics, INO-CNR BEC Center and University of Trento, Italy

2002-2007: Degree in Physics, University of Bologna, Italy

### **Selected conference talks**

- 6) "Non-equilibrium Many-Body Physics with Strongly Coupled Atoms and Photons",  
Conference: Max-Planck Society Symposium, Berlin 2016
- 5) "A Crystal of Atoms and Photons in Free Space",  
Conference: Winter Colloquium - Physics of Quantum Electronics, Snowbird(UTAH) 2016
- 4) "Dynamical Self-Ordering of Superfluids and Light",  
Conference: Quantum Optics, Obergurgl, 2016
- 3) "Quantum Kinetics of Ultracold Atoms inside an Optical Cavity",  
Conference: Strongly correlated fluids of light and matter, Trento, 2015
- 2) "Critical Velocity and Current-Phase Relation of Dilute Ultracold Bosonic Atoms",  
Conference: Nonlinear Waves-Theory and Applications, Beijing 2013
- 1) "Quantum Metrology with Spatially Resolved Atom Detection",  
Conference: Theory of Quantum Gases and Quantum Coherence, Lyon 2012

### **Reviewer for:**

- Physical Review Letters
- Physical Review A
- Europhysics Letters
- New Journal of Physics
- European Journal of Physics B
- European Journal of Physics D
- Annals of Physics
- Nature - Scientific Reports

### **Financed Projects and Awards**

- 1) *Max-Planck Research Group Leader* ("Centrally Announced Group"). Awarded in 2016 from the Max-Planck Society.
- 2) *APART Fellowship*. Awarded in 2014 from the Austrian Academy of Science.  
Title: "Strongly Correlated Atoms Inside an Optical Resonator".
- 3) *Von Humboldt Fellowship*. Awarded in 2011 from the Alexander Von Humboldt Foundation.  
Title: "Many-Body Physics with Atoms inside Optical Cavities".

## External Collaborations

- Darrick Chang, ICFO Barcelona, Spain  
*Collaborating on strongly interacting photons*
- Jan Chwedenczuk, University of Warsaw  
*Collaborating on quantum metrology*
- Farokh Mivehvar, ITP Innsbruck, Austria.  
*Collaborating on topological crystals of light and matter*
- Matthias Punk, LMU Munich, Germany  
*Collaborating on strongly-correlated electrons and spin liquids*
- Alessio Recati, TU Munich, Germany + BEC Trento, Italy  
*Collaborating on ultracold gases, quantum field theory*
- Helmut Ritsch, ITP Innsbruck, Austria.  
*Collaborating on crystals of light and matter, quantum metrology*
- Tomasz Wasak, University of Warsaw  
*Collaborating on quantum metrology*
- Wilhelm Zwerger, TU Munich, Germany  
*Collaborating on non-equilibrium quantum field theory, strongly correlated electrons*

## Scientific Supervision

- Stefan Ostermann, ITP Innsbruck, Austria  
*Co-supervising Ph.D. activity on crystals of light and matter*
- Johannes Lang, TU Munich, Germany  
*Co-supervising Ph.D. activity on non-equilibrium quantum field-theory and strongly interacting photons*
- Michael Rips, TU Munich, Germany  
*Supervised Master thesis on crystals of light and matter*
- Karol Gietka, University of Warsaw, Poland  
*Co-supervising Ph.D. activity on quantum metrology in cavity QED*

## Teaching Experience

- Quantum Mechanics, Technical University of Munich (2014).  
*Teaching coordinator (“Übungsleiter”). Occasionally teaching substitute (“Lehrvertretung”).*
- Theoretical Solid State Physics, Technical University of Munich (2013-2014).  
*Teaching coordinator (“Übungsleiter”). Occasionally teaching substitute (“Lehrvertretung”).*
- General Physics I, University of Trento (2008-2009).  
*Teaching assistant.*

# Publications

For publications statistics please visit Google Scholar:

[http://scholar.google.it/citations?sortby=pubdate&hl=it&user=oLqiPjEAAAAJ&view\\_op=list\\_works](http://scholar.google.it/citations?sortby=pubdate&hl=it&user=oLqiPjEAAAAJ&view_op=list_works)

## Preprints

1. “Collective excitations and supersolid behavior of bosonic atoms inside two crossed optical cavities”, J. Lang, F. Piazza, W. Zwerger, [arXiv:1707.00017 \(2017\)](#)
2. “Disorder-Driven Density and Spin Self-Ordering of a Spinor Bose-Einstein Condensate in a Cavity”, F. Mivehvar, F. Piazza, H. Ritsch, [arXiv:1705.06382 \(2017\)](#)
3. “Enhancing interferometric sensitivity by non-classical light from quantum non-demolition measurements in cavity QED”, K. Gietka, T. Wasak, J. Chwedenczuk, F. Piazza, H. Ritsch, [arXiv:1703.03651 \(2017\)](#)
4. “Breaking of Goldstone modes in two component Bose-Einstein condensate”, A. Recati and F. Piazza, [arXiv:1602.05102 \(2016\)](#)

## Published

1. “Superradiant Topological Peierls Insulator inside an Optical Cavity”, F. Mivehvar, H. Ritsch, and F. Piazza, [Physical Review Letters 118, 073602 \(2017\)](#); [arXiv:1611.04876](#)
2. “Critical Relaxation with Overdamped Quasi-Particles in Driven-Dissipative Systems”, J. Lang and F. Piazza, [Phys. Rev. A 94, 033628 \(2016\)](#); [arXiv:1602.05102](#)
3. “Spontaneous crystallization of light and ultracold atoms”, S. Ostermann, F. Piazza and H. Ritsch, [Physical Review X 6, 021026 \(2016\)](#); [arXiv:1601.04900](#)
4. “Self-organised limit-cycles, chaos and phase-slippage with a superfluid inside an optical resonator”, F. Piazza and H. Ritsch, [Phys. Rev. Lett. 115, 163601 \(2015\)](#); [arXiv:1507.08644](#)
5. “Self-ordered stationary states of driven quantum degenerate gases in optical resonators”, R. M. Sandner, W. Niedenzu, F. Piazza, H. Ritsch, [Europhys. Lett. 111, 53001 \(2015\)](#); [arXiv:1507.00271](#)
6. “FFLO strange metal and quantum criticality in two dimensions: theory and experimental evidence in organic superconductors”, F. Piazza, W. Zwerger, P. Strack, [Physical Review B 93, 085112 \(2016\)](#); [arXiv:1506.08819](#)
7. “Parity Symmetry Breaking and Topological Phases in a Superfluid Ring”, X. Zhang, F. Piazza, W. Li, A. Smerzi, [Phys. Rev. A 94, 063601 \(2016\)](#); [arXiv:1608.01904](#)
8. “Instability of the superfluid flow as black-hole lasing effect”, S. Finazzi, F. Piazza, M. Abad, A. Smerzi, A. Recati, [Phys. Rev. Lett. 114, 245301 \(2015\)](#); [arXiv:1409.8068](#)
9. “Phase-slips and vortex dynamics in Josephson oscillations between Bose-Einstein condensates”, M. Abad, M. Guilleumas, R. Mayol, F. Piazza, D. M. Jezek, and A. Smerzi, [Europhys. Lett. 109, 40005 \(2015\)](#); [arXiv:1409.5598](#)
10. “Quantum kinetics of ultracold fermions coupled to an optical resonator”, F. Piazza and P. Strack, [Phys. Rev. A 90, 043823 \(2014\)](#); [arXiv:1407.5642](#)
11. “Umklapp Superradiance with a Collisionless Quantum Degenerate Fermi Gas”, F. Piazza and P. Strack, [Phys. Rev. Lett. 112, 143003 \(2014\)](#); [arXiv:1309.2714](#)
12. “Bose-Einstein Condensation versus Dicke-Hepp-Lieb Transition in an Optical Cavity”, F. Piazza and P. Strack, and W. Zwerger, [Ann. of Phys. 339, 135 \(2013\)](#); [arXiv:1305.2928](#)

13. “Critical velocity for a toroidal BoseEinstein condensate flowing through a barrier”, F. Piazza, L. A. Collins, and A. Smerzi, *J. Phys. B: At. Mol. Opt. Phys.* **46**, 095302 (2013); arXiv:1208.0734
14. “Multipath interferometer with ultracold atoms trapped in an optical lattice”, J. Chwedeńczuk, F. Piazza, A. Smerzi, *Phys. Rev. A* **87**, 033607 (2013); arXiv:1210.4772
15. “Sub shot-noise interferometry from measurements of the one-body density”, J. Chwedeńczuk, P. Hyllus, F. Piazza, A. Smerzi, *New J. Phys.* **14**, 093001 (2012); arXiv:1108.2785
16. “Phase Estimation from Atom Position Measurements”, J. Chwedeńczuk, F. Piazza, A. Smerzi, *New J. Phys.* **13**, 065023 (2011); arXiv:1012.3593
17. “Instability and Vortex Rings Dynamics in a Three-Dimensional Superfluid Flow Through a Constriction”, F. Piazza, L. A. Collins, and A. Smerzi, *New J. Phys.* **13**, 043008 (2011); arXiv:1011.5041
18. “Dynamics of a tunable superfluid junction”, L. J. LeBlanc, A. B. Bardou, J. McKeever, M. H. T. Extavour, D. Jervis, J. H. Thywissen, F. Piazza, A. Smerzi, *Phys. Rev. Lett.* **106**, 025302 (2010); arXiv:1006.3550
19. “Phase Estimation With Interfering Bose-Condensed Atomic Clouds”, J. Chwedeńczuk, F. Piazza, A. Smerzi, *Phys. Rev. A* **82**, 051601(R) (2010); arXiv:1007.0703
20. “Rabi Interferometry and Sensitive Measurement of the Casimir-Polder Force with Ultra-Cold Gases”, J. Chwedeńczuk, L. Pezzé, F. Piazza, A. Smerzi, *Phys. Rev. A* **82**, 032104 (2010); arXiv:0909.0705
21. “Current-phase relation of a Bose-Einstein condensate flowing through a weak link”, F. Piazza, L. A. Collins, and A. Smerzi, *Phys. Rev. A* **81**, 033613 (2010); arXiv:0912.3209
22. “Critical velocity of superfluid flow through single-barrier and periodic potentials”, G. Watanabe, F. Dalfovo, F. Piazza, L. P. Pitaevskii, and S. Stringari, *Phys. Rev. A* **80**, 053602 (2009); arXiv:0907.0621
23. “Vortex-induced phase-slip dissipation in a toroidal Bose-Einstein condensate flowing through a barrier”, F. Piazza, L. A. Collins, and A. Smerzi, *Phys. Rev. A* **80**, 021601(R) (2009); arXiv:0903.2534
24. “Macroscopic Superpositions of Phase States with Bose-Einstein condensates”, F. Piazza, L. Pezzé and A. Smerzi, *Phys. Rev. A* **78**, 051601(R) (2008); arXiv:0803.2265

### Book Contributions

1. F. Piazza, L. A. Collins, and A. Smerzi, chapter contribution to the book “[Physics of Quantum Fluids - New Trends and hot topics in atomic and polariton condensates](#)”, Springer (2013)

### Highlights

1. Synopsis on “APS-Physics” [May 24, 2016](#)
2. Cover page of “Physical Review Letters”, [Volume 115, Issue 16 \(2015\)](#)
3. Research Highlights on “Nature Physics”, [Nat. Phys. 4, 903 \(2008\)](#);