

Elenco Pubblicazioni

[1] Title: On-chip notch filter on a silicon nitride ring resonator for Brillouin spectroscopy

Authors: Antonacci, G., Elsayad, K., Polli, D.

Journal: ACS Photonics **Journal IF:** 7.5

Volume: 9 **Number:** 3 **Year:** 2022

DOI: 10.1021/acsp Photonics.2c00005

[2] Title: Ultra-sensitive refractive index gas sensor with functionalized silicon nitride photonic circuits

Authors: Antonacci, G., Goyvaerts, J., Zhao, H., Baumgartner, B., Lendl, B. Baets, R.

Journal: APL Photonics **Journal IF:** 5.7

Volume: 5 **Number:** 8 **Year:** 2020

DOI: 10.1063/5.0013577

Citations: 14

Notes: The paper was listed as the journal Editor's Featured Article and had media coverage on the associated Scilight journal (DOI: 10.1063/10.0001798)

[3] Title: Brillouin microscopy – an emerging tool for mechanobiology

Authors: Prevedel, R., Diz-Muñoz, A., Ruocco, G., Antonacci, G.

Journal: Nature Methods **Journal IF:** 28.5

Volume: 16 **Number:** 10 **Year:** 2019

DOI: 10.1038/s41592-019-0543-3

Citations: 95

Notes: Nature Altmetric: 31; Tweets: 65; Mendeley: 262

[4] Title: Scattering Assisted Imaging

Authors: Leonetti, M., Grimaldi, A., Ghirga, S., Ruocco, G., Antonacci, G.

Journal: Scientific Reports **Journal IF:** 4.4

Volume: 9 **Number:** 4591 **Year:** 2019

DOI: 10.1038/s41598-019-40997-6

Citations: 3

[5] Title: Background-deflection Brillouin microscopy reveals altered biomechanics of intracellular stress granules by ALS protein FUS

Authors: Antonacci, G., de Turris, V., Rosa, A., Ruocco, G.

Journal: Communication Biology **Journal IF:** 6.3

Volume: 1 **Number:** 1 **Year:** 2018

DOI: 10.1038/s42003-018-0148-x

Citations: 32

Notes: Media coverage on Wired; Il Fatto Quotidiano; Rai News and others. Nature Altmetric 44

[6] Title: Cancellation of Bessel beam side lobes for high-contrast light sheet microscopy

Authors: Di Domenico, G., Ruocco G., Colosi C., DelRe E., **Antonacci, G.**

Journal: Scientific Reports **Journal IF:** 4.4

Volume: 8 **Number:** 1 **Year:** 2018

DOI: 10.1038/s41598-018-35006-1

Citations: 17

[7] Title: Diffraction-free light droplets for axially-resolved volume imaging

Authors: **Antonacci, G.**, Di Domenico, DelRe E., G., Ruocco G

Journal: Scientific Reports **Journal IF:** 4.4

Volume: 7 **Number:** 41598 **Year:** 2017

DOI: 10.1038/s41598-017-00042-w

Citations: 14

Notes: Featured in the Physics Department website of Sapienza University.

[8] Title: Dark-field Brillouin microscopy

Authors: **Antonacci, G.**

Journal: Optics Letters **Journal IF:** 3.8

Volume: 42 **Number:** 7 **Year:** 2017

DOI: 10.1364/OL.42.001432

Citations: 19

[9] Title: Biomechanics of subcellular structures by non-invasive Brillouin microscopy

Authors: **Antonacci, G.**, Brakman, S.

Journal: Scientific Reports **Journal IF:** 4.4

Volume: 6 **Number:** 3721 **Year:** 2016

DOI: 10.1038/srep37217

Citations: 78

[10] Title: Breaking the contrast limit in Fabry-Perot spectrometers

Authors: **Antonacci, G.**, De Panfilis S., Di Domenico G., DelRe E., Ruocco G.,

Journal: Physical Review Applied **Journal IF:** 5.0

Volume: 6 **Number:** 054020 **Year:** 2016

DOI: 10.1103/PhysRevApplied.6.054020

Citations: 16

[11] Title: Quantification of plaque stiffness by Brillouin Microscopy in experimental thin cap fibroatheroma

Authors: **Antonacci, G.**, Pedrigi R.M., Kondiboyina A., Mehta V.V., De Silva R., Paterson C., Krams R., Török P.

Journal: J. Roy. Soc. Interface **Journal IF:** 4.1

Volume: 12 **Number:** 112 **Year:** 2015

DOI: 10.1098/rsif.2015.0843

Citations: 68

[12] Title: Elastic suppression in Brillouin imaging by destructive interference

Authors: Antonacci G, Lepert G, Paterson C, Török P.

Journal: Applied Physics Letters **Journal IF:** 3.8

Volume: 107 **Number:** 6 **Year:** 2015

DOI: 10.1063/1.4927400

Citations: 41

Tesi di Dottorato

Title: Brillouin scattering microscopy for mechanical imaging

Year: 2015;

Supervisor: Prof. Peter Török;

Host Institution: Imperial College London

Elenco numerato delle pubblicazioni scientifiche allegate Luca Bursi

- [1] L. Bursi, A. Calzolari, S. Corni, E. Molinari. Light-induced field enhancement in nanoscale systems from first-principles: the case of polyacenes. *ACS Photonics*, **1** (10), 1049–1058 (2014).
- [2] L. Bursi, A. Calzolari, S. Corni, E. Molinari. Quantifying the plasmonic character of optical excitations in nanostructures. *ACS Photonics*, **3** (4), 520–525 (2016).
- [3] R. Zhang, L. Bursi, J. D. Cox, Y. Cui, C. M. Krauter, A. Alabastri, A. Manjavacas, A. Calzolari, S. Corni, E. Molinari, E. A. Carter, F. J. García de Abajo, H. Zhang, P. Nordlander. How to identify plasmons from the optical response of nanostructures. *ACS Nano*, **11** (7), 7321–7335 (2017).
- [4] K. D. Chapkin, L. Bursi, G. J. Stec, A. Lauchner, N. J. Hogan, Y. Cui, P. Nordlander, N. J. Halas. Lifetime dynamics of plasmons in the few-atom limit. *Proc. Natl. Acad. Sci. USA*, **115** (37), 9134–9139 (2018).
- [5] K. W. Smith, L. A. McCarthy, A. Alabastri, L. Bursi, W-S Chang, P. Nordlander, S. Link. Exploiting evanescent field polarization for giant chiroptical modulation from achiral gold half-rings. *ACS Nano*, **12** (11), 11657–11663 (2018).
- [6] B. D. Clark, C. J. DeSantis, G. Wu, D. Renard, M. J. McClain, L. Bursi, A.-L. Tsai, P. Nordlander, N. J. Halas. Ligand-dependent colloidal stability controls the growth of aluminum nanocrystals. *J. Am. Chem. Soc.*, **141** (4), 1716–1724 (2019).
- [7] B. D. Clark, C. R. Jacobson, M. Lou, D. Renard, G. Wu, L. Bursi, A. S. Ali, D. F. Swearer, A.-L. Tsai, P. Nordlander, N. J. Halas. Aluminum nanocubes have sharp corners. *ACS Nano*, **13** (8), 9682–9691 (2019).
- [8] L. A. McCarthy, K. W. Smith, X. Lana, S. A. Hosseini Jebeli, L. Bursi, A. Alabastri, W.-S. Chang, P. Nordlander, S. Link. Polarized evanescent waves reveal trochoidal dichroism. *Proc. Natl. Acad. Sci. USA*, **117** (28), 16143–16148 (2020).
- [9] K. D. Chapkin, L. Bursi, B. D. Clark, G. Wu, A. Lauchner, A.-L. Tsai, P. Nordlander, N. J. Halas. Effects of electronic structure on molecular plasmon dynamics. *J. Phys. Chem. C*, **124** (37), 20450–20457 (2020).
- [10] S. S. E. Collins, E. K. Searles, L. J. Tauzin, M. Lou, L. Bursi, Y. Liu, J. Song, C. Flatebo, R. Baiyasi, Y.-Y. Cai, B. Foerster, T. Lian, P. Nordlander, S. Link, C. F. Landes. Plasmon energy transfer in hybrid nanoantennas. *ACS Nano*, **15** (6), 9522–9530 (2021).
- [11] N. Karmodak, L. Bursi, O. Andreussi. Oxygen evolution and reduction on two-dimensional transition metal dichalcogenides. *J. Phys. Chem. Lett.*, **13** (1), 58–65 (2022).

- [12] V. Lloveras, P. Elías-Rodríguez, L. Bursi, E. Shirdel, A. R. Goñi, A. Calzolari, J. Vidal-Gancedo. Multifunctional Switch Based on Spin-Labeled Gold Nanoparticles.
Nano Lett., **22** (2), 768–774 (2022).
- [13] L. Bursi. Tesi di dottorato di ricerca intitolata: Metodi quantitativi per la determinazione del carattere plasmonico delle eccitazioni ottiche alla nanoscala. Università di Modena e Reggio Emilia, marzo 2017.

Modena, lì 11/05/2022

Luca Bursi

Publication list

1. A. Tononi, A. Cappellaro, G. Bighin and L. Salasnich,
Propagation of first and second sound in a two-dimensional Fermi superfluid
Phys. Rev. A **103**, L061303 (2021) <https://doi.org/10.1103/PhysRevA.103.L061303>
2. A. Cappellaro and L. Salasnich,
Shift of the critical temperature in superconductors: a self-consistent approach
Scientific Reports **10**, 9088 (2020) <https://doi.org/10.1038/s41598-020-65790-8>
3. A. Tononi, F. Toigo, S. M. Wimberger, A. Cappellaro and L. Salasnich,
Dephasing-rephasing dynamics of one-dimensional tunneling quasicondensates
New J. Phys. **22**, 073020 (2020) <https://doi.org/10.1088/1367-2630/ab965d>
4. A. Cappellaro and L. Salasnich,
Effective field theory of bosons with finite-range interaction in a disordered environment
Phys. Rev. A **101**, 053628 (2020) <https://doi.org/10.1103/PhysRevA.101.053628>
5. A. Cappellaro and L. Salasnich,
Superfluids, Fluctuations and Disorder
Appl. Sci. **9**(7), 1498 (2019) <https://doi.org/10.3390/app9071498>
6. A. Tononi, A. Cappellaro and L. Salasnich,
Condensation and superfluidity of dilute Bose gases with finite-range interaction
New J. Phys. **20**, 125007 (2018) <https://doi.org/10.1088/1367-2630/aaf75e>
7. A. Cappellaro, F. Toigo and L. Salasnich,
Collisionless dynamics in two-dimensional Bose gases
Phys. Rev. A **98**, 043605 (2018) <https://doi.org/10.1103/PhysRevA.98.043605>
8. A. Cappellaro, T. Macrí and L. Salasnich,
Collective modes across the soliton-droplet crossover in binary Bose mixtures
Phys. Rev. A **97**, 053623 (2018) <https://doi.org/10.1103/PhysRevA.97.053623>
9. A. Cappellaro and L. Salasnich,
Finite-range corrections to the thermodynamics of the one-dimensional Bose gas
Phys. Rev. A **96**, 063610 (2017) <https://doi.org/10.1103/PhysRevA.96.063610>
10. F. Cinti, A. Cappellaro, T. Macrí and L. Salasnich,
Superfluid Filaments of dipolar bosons in free space
Phys. Rev. Lett. **119**, 215302 (2017) <https://doi.org/10.1103/PhysRevLett.119.215302>
11. A. Cappellaro, T. Macrí, G. F. Bertacco, L. Salasnich,
Equation of state and self-bound droplet in Rabi-coupled Bose mixtures
Scientific Reports **7**, 13358 (2017) <https://doi.org/10.1038/s41598-017-13647-y>
12. F. Baldovin, A. Cappellaro, E. Orlandini and L. Salasnich,

Nonequilibrium statistical mechanics in one-dimensional bose gases

J. Stat. Mech., 063303 (2016) <https://doi.org/10.1088/1742-5468/2016/06/063303>

Tesi di Dottorato

Titolo: “*Ultracold Quantum Gases: Beyond-Mean-Field Effects*”

Supervisor: Prof. Luca Salasnich

Data Difesa: 12/12/2018 (Padova)

Esito: Positivo Cum Laude

1. Cea T., Benfatto L. (2016). Signature of the Leggett mode in the A(1g) Raman response: From MgB₂ to iron-based superconductors. PHYSICAL REVIEW. B, vol. 94, ISSN: 2469-9950, doi: 10.1103/PhysRevB.94.064512 - *Articolo in rivista*
2. Cea, T., Barone, P., Castellani, C., Benfatto, L. (2018). Polarization dependence of the third-harmonic generation in multiband superconductors. PHYSICAL REVIEW. B, vol. 97, p. 0945161-0945167, ISSN: 2469-9950, doi: 10.1103/PhysRevB.97.094516 - *Articolo in rivista*
3. Ares P, Cea T, Holwill M, Wang Y B, Roldán R, Guinea F, Andreeva D V, Fumagalli L, Novoselov K S, Woods C R (2020). Piezoelectricity in Monolayer Hexagonal Boron Nitride. ADVANCED MATERIALS, vol. 32, 1905504, ISSN: 0935-9648, doi: 10.1002/adma.201905504 - *Articolo in rivista*
4. Giorgianni Flavio, Cea Tommaso, Vicario Carlo, Hauri Christoph P., Withanage Wenura K., Xi Xiaoxing, Benfatto Lara (2019). Leggett mode controlled by light pulses. NATURE PHYSICS, vol. 15, p. 341-347, ISSN: 1745-2473, doi: 10.1038/s41567-018-0385-4 - *Articolo in rivista*
5. CEA, TOMMASO, CASTELLANI, Claudio, SEIBOLD, GOTZ ULRICH, BENFATTO, Lara (2015). Nonrelativistic Dynamics of the Amplitude (Higgs) Mode in Superconductors. PHYSICAL REVIEW LETTERS, vol. 115, p. 1-6, ISSN: 0031-9007, doi: 10.1103/PhysRevLett.115.157002 - *Articolo in rivista*
6. Mesple F, Missaoui A, Cea T, Huder L, Guinea F, Trambly de Laissardière G, Chapelier C, Renard VT (2021). Heterostrain Determines Flat Bands in Magic-Angle Twisted Graphene Layers. PHYSICAL REVIEW LETTERS, vol. 127, ISSN: 0031-9007, doi: 10.1103/PhysRevLett.127.126405 - *Articolo in rivista*

7. Cea T, Guinea F (2021). Coulomb interaction, phonons, and superconductivity in twisted bilayer graphene. PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA, vol. 118, ISSN: 1091-6490, doi: 10.1073/pnas.2107874118 - *Articolo in rivista*
8. Cea T, Walet N R, Guinea F (2019). Twists and the Electronic Structure of Graphitic Materials. NANO LETTERS, vol. 19, p. 8683-8689, ISSN: 1530-6984, doi: 10.1021/acs.nanolett.9b03335 - *Articolo in rivista*
9. CEA, TOMMASO, CASTELLANI, Claudio, BENFATTO, Lara (2016). Nonlinear optical effects and third-harmonic generation in superconductors: Cooper pairs versus Higgs mode contribution. PHYSICAL REVIEW. B, vol. 93, p. 1-5, ISSN: 2469-9950, doi: 10.1103/PhysRevB.93.180507 - *Articolo in rivista*
10. Cea T, Guinea F (2020). Band structure and insulating states driven by Coulomb interaction in twisted bilayer graphene. PHYSICAL REVIEW. B, vol. 102, 045107, ISSN: 2469-9969, doi: 10.1103/PhysRevB.102.045107 - *Articolo in rivista*
11. Cea T, Walet N R, Guinea F (2019). Electronic band structure and pinning of Fermi energy to Van Hove singularities in twisted bilayer graphene: A self-consistent approach. PHYSICAL REVIEW. B, vol. 100, 205113, ISSN: 2469-9950, doi: 10.1103/PhysRevB.100.205113 - *Articolo in rivista*
12. Grasset Romain, Cea Tommaso, Gallais Yann, Cazayous Maximilien, Sacuto Alain, Cario Laurent, Benfatto Lara, Measson Marie-Aude (2018). Higgs-mode radiance and charge-density-wave order in 2H-NbSe₂. PHYSICAL REVIEW. B, vol. 97, ISSN: 2469-9950, doi: 10.1103/PhysRevB.97.094502 - *Articolo in rivista*

Tesi di dottorato: “Unconventional dynamics and spectroscopy in superconductors”

Elenco Tesi e Pubblicazioni Presentate

Laura Fanfarillo, Ph.D.

- [T1.] L. Fanfarillo,
Transport properties in multichannel systems,
Ph.D Thesis. Sapienza University of Rome 2013.
- [P1.] L. Fanfarillo, A. Cortijo, B. Valenzuela,
Spin-orbital interplay and topology in the nematic phase of iron pnictides,
Phys. Rev. B **91**, 214515 (2015),
published by the American Physical Society, 22 June 2015.
IF 2015: 3.929, Numero citazioni: 37 (Scholar), 24 (WoS)
- [P2.] L. Fanfarillo and E. Bascones,
Electronic correlations in Hund metals,
Phys. Rev. B **92**, 075136 (2015),
published by the American Physical Society, 24 August 2015.
IF 2015: 3.929, Numero citazioni: 81 (Scholar), 59 (WoS)
- [P3.] L. Fanfarillo, M. Mori, M. Campetella, M. Grilli, S. Caprara,
Glue function of optimally and overdoped cuprates from inversion of the Raman spectra,
Journal of Physics: Condensed Matter **28**, 065701 (2016),
published by the IOP-Institute of Physics, 21 Gennaio 2016.
IF 2016: 2.649, Numero citazioni: 6 (Scholar), 3 (WoS)
- [P4.] L. Fanfarillo, J. Mansart, P. Toulemonde, H. Cercellier, P. Le Fevre, F. Bertran,
B. Valenzuela, L. Benfatto, V. Brouet,
Orbital-dependent Fermi Surface shrinking as a fingerprint of nematicity in FeSe,
Phys. Rev. B **94**, 155138 (2016),
published by the American Physical Society, 21 October 2016.
IF 2016: 3.718 , Numero citazioni: 109 (Scholar), 81 (WoS)
- [P5.] L. Fanfarillo, G. Giovannetti, M. Capone and E. Bascones,
Nematicity at the Hund's metal crossover in iron superconductors,
Phys. Rev. B **95**, 144511 (2017),
published by the American Physical Society, 24 April 2017.
IF 2017: 3.836, Numero citazioni: 58 (Scholar), 41 (WoS)
- [P6.] L. Fanfarillo, L. Benfatto, B. Valenzuela,
Orbital mismatch boosting nematic instability in iron-based superconductors,

- Phys. Rev. B **97**, 121109(R) (2018)
published by the American Physical Society, 22 March 2018.
IF 2018: 3.813, Numero citazioni: 28 (Scholar), 21 (WoS)
- [P7.] L. Benfatto, B. Valenzuela, L. Fanfarillo,
Nematic Pairing from Orbital Selective Spin Fluctuations in FeSe,
npj Quantum material **3**, 56 (2018)
published by Nature Publishing Group, 2 November 2018.
IF 2018: 7.294, Numero citazioni: 47 (Scholar), 37 (WoS)
- [P8.] R. Fernandez-Martin, L. Fanfarillo, L. Benfatto, B. Valenzuela,
Anisotropy of the dc conductivity due to orbital-selective spin fluctuations in the nematic phase of iron superconductors,
Phys. Rev. B **99**, 155117 (2019)
published by the American Physical Society, 9 April 2019.
IF 2019: 3.582, Numero citazioni: 9 (Scholar), 3 (WoS)
- [P9.] A. Isidori, M. Berovic, L. Fanfarillo, L. de'Medici, M. Fabrizio, M. Capone,
Charge disproportionation, mixed valence, and Janus effect in multiorbital systems: A tale of two insulators,
Phys. Rev. Lett. **122**, 186401 (2019)
published by the American Physical Society, 7 May 2019.
IF 2019: 8.385, Numero citazioni: 33 (Scholar), 25 (WoS)
- [P10.] S. Bhattacharyya, K. Bjornson, K. Zantout, D. Steffensen, L. Fanfarillo, A. Kreisel, R. Valenti, B.M. Andersen, P.J. Hirschfeld
Nonlocal correlations in iron pnictides and chalcogenides,
Phys. Rev. B **102**, 035109 (2020)
published by the American Physical Society, 6 July 2020.
IF 2020: 4.036, Numero citazioni: 21 (Scholar), 13 (WoS)
- [P11.] L. Fanfarillo, A. Valli, M. Capone,
Synergy between Hund-driven correlations and boson-mediated superconductivity,
Phys. Rev. Lett. **125**, 177001 (2020)
published by the American Physical Society, 21 October 2020.
IF 2020: 9.161, Numero citazioni: 10 (Scholar), 6 (WoS)
- [P12.] S.R. Xie, Y. Quan, A. Hire, , B. Deng, J.M. DeStefano, I. Salinas, U.S. Shah, L. Fanfarillo, J. Lim, J. Kim, G.R. Stewart, J.J. Hamlin, P.J. Hirschfeld, R.G. Hennig,
Machine learning of superconducting critical temperature from Eliashberg theory,
npj Computational Materials **8**, 1 (2022)

published by Nature Publishing Group, 25 January 2022.

IF 2021: 13.2, Numero citazioni: 3 (Scholar), 0 (WoS)

Formato utilizzato:

Autori

Titolo

Referenza bibliografica

Editore e data di pubblicazione

Impact factor nell'anno di pubblicazione, Numero citazioni xx (google scholar), xx (Web of Science)

Trieste, April 28, 2022

Laura Fanfarillo

NOTA: i criteri adottati dal candidato per la scelta delle pubblicazioni presentate non sono né il rango della rivista, né il numero di citazioni, né il peso specifico del candidato. Invece, si è cercato di fornire una panoramica il più possibile organica dell'attività di ricerca del candidato, specie in funzione delle richieste del bando.

La numerazione delle pubblicazioni presentate si riferisce alla lista totale (nel CV).

- [4] L. Lepori, G. Z. Toth, and G. Delfino, "Particle spectrum of the 3-state Potts model field theory: a numerical study", *J. Stat. Mech.* P11007 (2009).
<http://iopscience.iop.org/article/10.1088/1742-5468/2009/11/P11007/meta>
- [6] L. Lepori, G. Mussardo, and A. Trombettoni, "(3+1) massive Dirac fermions with ultracold atoms in frustrated optical lattices", *Europhys. Lett.* **92** 50003 (2010).
<http://iopscience.iop.org/article/10.1209/0295-5075/92/50003>
- [8] G. De Chiara, L. Lepori, M. Lewenstein, and A. Sanpera, "Entanglement Spectrum, Critical Exponents and Order Parameters in Quantum Spin Chains", *Phys. Rev. Lett.* **109**, 237208 (2012).
<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.109.237208>
- [10] L. Lepori, G. De Chiara, and A. Sanpera, "Scaling of the entanglement spectrum near quantum phase transitions", *Phys. Rev. B* **87** 235107 (2013).
<https://journals.aps.org/prb/abstract/10.1103/PhysRevB.87.235107>
- [13] D. Vodola, L. Lepori, E. Ercolessi, A. V. Gorshkov, and G. Pupillo, "Kitaev chains with long-range pairing", *Phys. Rev. Lett.* **113**, 156402 (2014).
<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.113.156402>
- [16] D. Vodola*, L. Lepori*, E. Ercolessi, and G. Pupillo, "Long-range Ising and Kitaev Models: Phases, Correlations and Edge Modes", *New Journ. Phys.*, Volume **18**, January 2016. Focus on Strongly interacting quantum gases in one dimension.
*: these authors contributed equally to the present paper.
<http://iopscience.iop.org/article/10.1088/1367-2630/18/1/015001/meta>
- [17] L. Lepori, D. Vodola, G. Pupillo, G. Gori, and A. Trombettoni, "Effective theories and breakdown of conformal symmetry in an long-range quantum chain", *Ann. Phys.* **374** 35-66 (2016).
<https://www.sciencedirect.com/science/article/pii/S0003491616301270>
- [18] L. Lepori, I. C. Fulga, A. Trombettoni, and M. Burrello, "Double-Weyl points and Fermi arcs of topological semimetals in non-Abelian gauge potentials", *Phys. Rev. A* **94** 053633 (2016).
<https://journals.aps.org/pra/abstract/10.1103/PhysRevA.94.053633>
- [23] S. Carignano, L. Lepori, A. Mammarella, M. Mannarelli, and G. Pagliaroli, "Scrutinizing the pion condensed phase", *Eur. Phys. Journ. A* **53** 35 (2017).
<https://link.springer.com/article/10.1140%2Fepja%2Fi2017-12221-x>
- [24] L. Lepori and L. Dell'Anna, "Long-range topological insulators and weakened bulk-boundary correspondence", *New Journ. Phys.* **19**, 103030 (2017).
<http://iopscience.iop.org/article/10.1088/1367-2630/aa84d0>

- [26] L. Pezzé, M. Gabbriellini, L. Lepori, and A. Smerzi, "Multipartite entanglement in topological quantum phases", *Phys. Rev. Lett.* **119**, 250401 (2017).
<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.119.250401>
- [39] S. S. Mirkhalaf, E. Witkowska, and L. Lepori, "Supersensitive quantum sensor based on criticality in an antiferromagnetic spinor condensate", *Phys. Rev. A* **101**, 043609 (2020).
<https://journals.aps.org/prl/abstract/10.1103/PhysRevA.101.043609>
- PhD thesis: "QFT emerging models in condensed matter systems".

Lista delle pubblicazioni scientifiche

1. *Uniformly frustrated XY model: strengthening of the vortex lattice by intrinsic disorder*
I. Maccari , L. Benfatto and C. Castellani
Condensed Matter 6 (4), 42 (2021)
2. *State with spontaneously broken time-reversal symmetry above the superconducting phase transition*
V. Grinenko, D. Weston, F. Caglieris, C. Wuttke, C. Hess, T. Gottschall, I. Maccari, D. Gorbunov, S. Zherlitsyn, J. Wosnitza, A. Rydh, K. Kihou, Chul-Ho Lee, R. Sarkar, S. Dengre, J. Garaud, A. Charnukha, R. Hühne, K. Nielsch, B. Büchner, Hans-Henning Klauss, and E. Babaev
Nature Physics 17, 1254–1259 (2021)
3. *Finite-Frequency Dissipation in Two-Dimensional Superconductors with Disorder at the Nanoscale*
G. Venditti, I. Maccari, M. Grilli and S. Caprara
Nanomaterials 11 (8), 1888 (2021)
4. *Interplay of spin waves and vortices in the two-dimensional XY model at small vortex-core energy*
I. Maccari , N. Defenu , L. Benfatto , C. Castellani, and T. Enss
Phys. Rev. B 102 (10), 104505 (2020)
5. *Superfluid Properties of Superconductors with Disorder at the Nanoscale: A Random Impedance Model*
G. Venditti, I. Maccari, M. Grilli, S. Caprara
Condensed Matter 5 (2), 36 (2020)
6. *Melting of the vortex lattice through intermediate hexatic fluid in a-MoGe thin film*
I. Roy, S. Dutta, A. N. R. Choudhury, S. Basistha, I. Maccari, S. Mandal, J. Jesudasan, V. Bagwe, C. Castellani, L. Benfatto, P. Raychaudhuri
Phys. Rev. Lett. 122 (4), 047001 (2019)
7. *Kane-Fisher weak link physics in the clean scratched-XY model*
G. Lemarié, I. Maccari, C. Castellani
Phys. Rev. B 99 (5), 054519 (2019)
8. *Disordered XY model: effective medium theory and beyond*
I Maccari, L Benfatto, C Castellani
Phys. Rev. B 99 (10), 104509 (2019)
9. *The BKT Universality Class in the Presence of Correlated Disorder*
I. Maccari, L. Benfatto, C. Castellani
Condensed Matter 3 (1), 8 (2018)

10. *Broadening of the Berezinskii-Kosterlitz-Thouless transition by correlated disorder*
I. Maccari, L. Benfatto, C. Castellani
Phys. Rev. B 96 (6), 060508 13 (2017)
11. *Cytoskeleton rotation relocates mitochondria to the immunological synapse and increases calcium signals*
I. Maccari, R. Zhao, M. Peglow, K. Schwarz, I. Hornak, M. Pasche, A. Quintana, M. Hoth, B. Qu, H. Rieger
Cell calcium 60 (5), 309-321 18 (2016)
12. *A numerical study of planar arrays of correlated spin islands*
I. Maccari, A. Maiorano, E. Marinari, J.J. Ruiz-Lorenzo The European Physical Journal B 89 (5), 127 (2016)

Tesi di dottorato

- "Berezinskii-Kosterlitz-Thouless transition in disordered superconducting films".
Supervisor: Prof. Claudio Castellani and Prof. Lara Benfatto.

Stockholm, 10/05/22

ELENCO DELLE PUBBLICAZIONI SCIENTIFICHE SELEZIONATE E TESI DI DOTTORATO

1. Marco Fanizza; Matteo Rosati; Michalis Skotiniotis; John Calsamiglia Costa, Vittorio Giovannetti. Squeezing-enhanced communication on phase-noise channels. Quantum 5, pp. 608. 2021.
2. Andrea Cacioppo; Janis Noetzel; Matteo Rosati. Compound Channel Capacities under Energy Constraints and Application. Proc. 2021 IEEE ISIT, pp. 640. 2021.
3. Matias Bilkis; Matteo Rosati; Raul Morral Yepes; John Calsamiglia Costa. Real-time calibration of coherent-state receivers: Learning by trial and error. Physical Review Research 2, pp. 033295. 2020.
4. Maria García Díaz; Benjamin Deseif; Matteo Rosati; Dario Egloff; John Calsamiglia Costa; Andrea Smirne; Michalis Skotiniotis; Susana Huelga. Accessible coherence in open quantum system dynamics. Quantum. 4, pp.249. 2020.
5. Marco Fanizza; Matteo Rosati; Michalis Skotiniotis; John Calsamiglia Costa; Vittorio Giovannetti. Beyond the swap test: optimal estimation of quantum state overlap. Physical Review Letters. 124, pp.060503. 2020.
6. Maria Garcia Diaz; Kun Fang; Xin Wang; Matteo Rosati; Michalis Skotiniotis; John Calsamiglia Costa; Andreas Winter. Using and reusing coherence to realize quantum processes. Quantum. 2, pp.100. 2018.
7. Matteo Rosati; Andrea Mari; Vittorio Giovannetti. Narrow Bounds for the Quantum Capacity of Thermal Attenuators. Nature Communications. Nature. 9, pp.4339. 2018.
8. Matteo Rosati; Andrea Mari; Vittorio Giovannetti. Capacity of coherent-state adaptive decoders with interferometry and single-mode detectors. Physical Review A. APS. 96, pp.012317. 2017.
9. Matteo Rosati; Giacomo De Palma; Andrea Mari; Vittorio Giovannetti. Optimal quantum state discrimination via nested binary measurements. Physical Review A. APS. 95, pp.042307. 2017.
10. Matteo Rosati; Andrea Mari; Vittorio Giovannetti. Multi-Phase Hadamard receivers for classical communication on lossy bosonic channels. Physical Review A. APS. 94, pp.062325. 2016.
11. Matteo Rosati; Vittorio Giovannetti. Achieving the Holevo bound via a bisection decoding protocol. Journal of Mathematical Physics. AIP. 57, pp.062204. 2016.
12. Matteo Rosati; Andrea Mari; Vittorio Giovannetti. Coherent-state discrimination via non-heralded probabilistic amplification. Physical Review A. APS. 93, pp.062315. 2016.
13. Matteo Rosati. Decoding protocols for classical communication on quantum channels. PhD thesis - Scuola Normale Superiore (Supervisor: Prof. V. Giovannetti). 2017.

Elenco riasuntivo delle pubblicazioni presentate

1. **P. Villegas**, T. Gili & G. Caldarelli, Emergent spatial patterns of coexistence in species-rich plant communities, *Phys. Rev. E* 104, 034305. 2021.
2. **P.Villegas**, A.Cavagna, M.Cencini, H Fort & T.S.Griguera, Joint assessment of density correlations and fluctuations for analysing spatial tree patterns, *Roy. Soc. Open Sci.*, 8(1), 202200. 2021.
3. **P.Villegas**, M.A.Muñoz & J.A.Bonachela, Evolution in the Debian GNU/Linux software network: analogies and differences with gene regulatory networks, *J. R. Soc. Interface* 17 (163), 20190845. 2020.
4. **P.Villegas**, S.di Santo, R.Burioni & M.A.Muñoz, Time-series thresholding and the definition of avalanche size, *Phys. Rev. E* 100, 012133. 2019.
5. S.di Santo*, **P.Villegas***, R.Burioni & M.A.Muñoz, Landau-Ginzburg theory of cortex dynamics: scale-free avalanches emerge at the edge of synchronization, *Proc. Natl. Acad. Sci.*, 115(7), E1356-E1365. (*Joint 1st authors). 2018.
6. **P.Villegas**, J.M. Ruiz, J.Hidalgo & M.A.Muñoz, Intrinsic noise and deviations from criticality in Boolean gene-regulatory networks, *Sci. Rep.* 6, 34743. 2016.
7. **P.Villegas**, P.Moretti & M.A.Muñoz, Frustrated hierarchical synchronization and emergent complexity in the human connectome network, *Sci. Rep.* 4, 5990. 2014.
8. S.di Santo, **P.Villegas**, R.Burioni & M.A.Muñoz, Simple unified view of branching process statistics: Random walks in balanced logarithmic potentials, *Phys. Rev. E*, 95(3), 032115. 2017.
9. V. Buendía, **P. Villegas**, R. Burioni & M.A. Muñoz, Hybrid-type synchronization transitions: Where incipient oscillations, scale-free avalanches, and bistability live together, *Phys. Rev. Res.* 3 (2), 023224. 2021.
10. V. Buendía, **P. Villegas**, R. Burioni & M.A. Muñoz, The broad edge of synchronization and collective effects in brain networks, Accepted to be published in *Phil. Trans. Roy. Soc. A*. 2022.
11. V.Buendía, S.di Santo, **P.Villegas**, R.Burioni & M.A.Muñoz, Self-organized bistability and its possible relevance for brain dynamics, *Phys. Rev. Research* 2, 013318. 2020.
12. S.di Santo, **P.Villegas**, R.Burioni & M.A.Muñoz, Non-normality, reactivity, and intrinsic stochasticity in neural dynamics: a non-equilibrium potential approach, *J. Stat. Mech. Theory Exp.*, 2018(7), 073402. 2018.

Tesi di dottorato

1. **Villegas Góngora, P. Phases and phase transitions in living matter. Granada: Universidad de Granada, 2018. [<http://hdl.handle.net/10481/50139>]. ISBN: 9788491638186.**

Giuseppe Antonacci

Education

| | | |
|--|--|--|
| 2011 - 2015 <u>PhD</u> | Imperial College London | Blackett Laboratory (UK) Thesis: <i>Brillouin Scattering Microscopy for Mechanical Imaging</i> Supervisor: Prof. Peter Török; Co-Supervisor: Dr. Carl Paterson |
| 2009 - 2010 <u>MSc</u> <u>Optics & Photonics</u> | Imperial College London Mark: <i>Distinction</i> | Blackett Laboratory (UK) Thesis: <i>IR Spectroscopic Imaging for Cancer Diagnosis</i> Supervisor: Prof. Chris Phillips |
| 2005- 2008 <u>BSc Physics</u> | Sapienza University of Rome Mark: <i>105/110</i> | Physics Department (Italy) Thesis: <i>Bose-Einstein condensation in trapped gasses</i> Supervisor: Prof. Massimo Inguscio (former President of CNR) |

Current Positions

| | | |
|---|---------------------------------|---|
| 2021-Present <u>Visiting Researcher</u> | Politecnico di Milano | Physics Department (Italy) - Developing high-rejection notch filters for Brillouin spectroscopy - Combining Raman and Brillouin microscopy for simultaneous chemical and mechanical imaging |
| 2021-Present <u>Co-Founder & Scientific Director</u> | Specto Photonics (Italy) | - Responsible for technology direction, vision and long-term strategy - Coordinating the team and R&D activities |

Previous Positions

| | | |
|--|--|--|
| 2018-2020 <u>Project Leader</u> | Imec – Ghent University | Photonics Research Group (Belgium) - Coordinator of PIXAPP, the first EU pilot line for Photonics Integrated Circuit Packaging - Conceptualized, designed and demonstrated on-chip sensors with silicon nitride waveguides |
| 2015-2018 <u>Postdoc</u> | Italian Institute of Technology (IIT), Centre for Life Nano Science (Italy) | - Advanced Brillouin microscopy for biomedical applications - Developed optical imaging methods for label-free detection of ALS and Alzheimer's diseases - Conceived and demonstrated diffraction-free light droplets by Bessel beams interference |
| Jan-Aug 2015 <u>Research Associate</u> | Imperial College London | Blackett Laboratory (UK) - Implemented Brillouin microscopy with an ultra-narrowband notch filter |
| Sep-Oct 2013 <u>Visiting Researcher</u> | Wellman Center for Photomedicine, Harvard Medical School (USA) | - Developed a high-contrast VIPA spectrometer for biomechanical and fluorescence imaging |

Fellowships & Awards

| | |
|---------|---|
| 2021 | <i>National Scientific Habilitation</i> as Associate Professor in Experimental Physics (02/B1) |
| 2021 | <i>National Scientific Habilitation</i> as Associate Professor in Applied Physics (02/D1) |
| 2019-20 | <i>Short Term Scientific Mission (STSM)</i> grant awards by the EU COST Action CA16124 |
| 2019 | <i>Premio Nazionale dell'Innovazione (PNI)</i> |
| 2019 | <i>H2020 SME Instrument Phase 1</i> – Seal of Excellence Award |
| 2013 | <i>Santander Mobility Award</i> to pursue a research period at the Wellman Center for Photomedicine |
| 2011 | <i>EPSRC Doctoral Training Account</i> , PhD Scholarship at Imperial College London |
| 2011 | <i>Marie Curie ITN Fellowship</i> , CERN, Genève (declined in order to pursue my PhD studies) |

Memberships

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| 2022-Present | Technical Program Committee Member of the 2020 ICO and OWLS international conferences |
| 2021-Present | Board Member of the “International BioBrillouin Society” |
| 2016-Present | Member of the International Society for Optics and Photonics (SPIE) |
| 2015-2022 | Management Committee Member of the EU COST Action CA16124 “BioBrillouin” |

Teaching Activities

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| 2021 | Lecturer at the 5 th BioBrillouin Training School (virtual) |
| 2020 | Lecturer at the 3 rd BioBrillouin Training School at Ben-Gurion University |
| 2018 | External Lecturer for the Optics course for BSc students of SASS at Sapienza University |

2014-15 Lab tutor at the MSc Optics & Photonics course at Imperial College London

Supervision Activities

| | |
|---------|---|
| 2022 | MSc project co-supervisor of Marco Ventura at Politecnico di Milano |
| 2019 | MSc project co-supervisor of Ruben De Maesschalck at Ghent University |
| 2015-18 | PhD project co-supervisor of Giuseppe Di Domenico at Sapienza University |
| 2018 | Supervisor of Lorenzo Pasanisi, a visiting student from Berkley University working on Brillouin |
| 2017 | BSc project supervisor of Federica Zaccagnini at Istituto Italiano di Tecnologia working on Brillouin |
| 2014-15 | PhD project co-supervisor of Pei-Jung Wu working on Brillouin at Imperial College London |
| 2013-15 | PhD project co-supervisor of Chengze Song working on VIPA spectrometers at Imperial College |
| 2013 | EUROP placement student Co-Supervisor of Haocun Yu working on Brillouin at Imperial College |
| 2012 | MSc project co-supervisor of Roeland van Elsan at Imperial College London |
| 2011 | BSc project co-supervisor of Gabriel Lau at Imperial College London |

Reviewing Activities

| | |
|--------------|--|
| 2016-Present | Journal Reviewer: Nature Communications, Chemical Reviews, Light Science & Applications, Communications Biology, Analyst, Advances in Physics X, Biophysical Chemistry, Optics Express, Biomedical Optics Express, Optics Letters, ACS Applied Materials and Interfaces, Applied Optics, Analyst, J. Inn. Opt. Health Sci., MDPI Photonics, Applied Sciences, Optics Communications |
| 2016-Present | Grant Reviewer: ERC Consolidator, The Israel Science Foundation (Individual Research Grants) |

Editorial Activities

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|------|---|
| 2019 | Guest Editor for Data in Brief (Elsevier) Special Issue on “Optical microscopy and spectroscopy of single cells and molecules” |
|------|---|

Organization of scientific meetings

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|------|--|
| 2019 | Actively involved in the organization of the European Conference on Integrated Optics (ECIO) conference. The conference, hosted by Ghent University, was attended by about 240 participants. |
|------|--|

Institutional responsibilities

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|---------|--|
| 2016-18 | Laser Safety Officer of the Centre for Life Nano Science, IIT |
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Major Collaborations

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|--------------|---|
| 2022-Present | Prof. Scita (IFOM) – Application of Brillouin microscopy to investigate the biomechanical properties of intracellular nuclei in cancer metastases |
| 2020-Present | Prof. Baets (Ghent University) – Development of on-chip gas and biomedical sensors, 1 publication (APL Photonics) |
| 2021-Present | Prof. Cerullo, Prof. Polli (Politecnico di Milano) – Development of high-rejection Brillouin notch filters. 1 publication (ACS Photonics) |
| 2018-2019 | Dr Prevedel (EMBL) – Review paper on Brillouin microscopy (Nature Methods) |
| 2018-2019 | Prof. Schmidt (Leiden University) – Quantification of cellular forces and mechanical properties combining traction force micropillar and Brillouin microscopy (Biomedical Optics Express) |
| 2018-2019 | Dr Cortese (National Research Council-Nanotechnology Institute) – Investigation of mechanical response of glioma cells to substrates of different stiffnesses. 1 publication (Cancers) |
| Since 2017 | Dr Rosa (Sapienza University) – Investigation of intracellular phase transitions in ALS disease using Brillouin microscopy, 2 publications (1 Communication Biology, 1 Cell Report). |
| Since 2018 | Prof. Nistco’ (National Cancer Institute) – Investigation of the mechanical changes in normal and cancerous extracellular matrixes using Brillouin microscopy, 1 publication (JECCR) |
| 2015-2018 | Prof. Del Re (Sapienza University of Rome) – Generation of non-diffracting droplet beams for high-speed volumetric microscopy, 3 publications (2 Scientific Reports, 1 Applied Optics) |
| 2013-2015 | Prof. Krams (Imperial College London) – Quantifying plaque stiffness with Brillouin microscopy, 1 publication (Royal Society Interface) |
| 2013 | Prof. Scarcelli (Wellman Center for Photomedicine) – Characterization of VIPA spectrometers |

Summary of Publication Records

| | |
|--|------------|
| Peer-Review Publications (Total / First&Last Authored) | 26/16 |
| Total Citations | 1021 (730) |
| Average Citations per Product | 39 (29) |
| Hirsch (H) index | 16 (14) |

sources: Google Scholar (Scopus)

Grants & Funding

| Project Title | Funding source | Amount (Euros) | Period | Role | Description |
|--|----------------------------------|----------------|---------|--------------|---|
| BRE0000376 | Invitalia Brevetti+ | 103k | 2021-22 | PI | The funding aims at developing ultracompact on-chip Brillouin spectrometers. |
| On-Chip Brillouin Spectrometer | Horizon 2020 ActPHAST | 35k | 2021 | PI | We investigated the feasibility of an integrated Brillouin spectrometer on active photonics chips. |
| Assessing medical adhesive biomechanics | EU COST Action CA16124 - STSM | 5k | 2020 | PI | The grant aimed at measuring biomechanical properties on medical adhesives using Brillouin microscopy at the Vienna BioCenter |
| Development of a custom Brillouin microscope | EU COST Action CA16124 - STSM | 2.5k | 2019 | PI | We performed a feasibility study on the development of a custom Brillouin microscope at Politecnico di Milano. |
| Brillouin Light Microscopy | IIT-CrestOptics | ~300k | 2018 | PI | The project focused on the implementation and application of a Brillouin microscope. |
| High-Resolution Microscope with Bessel beam | LIFE 2020 (POR FESR LAZIO) | ~580k | 2018 | Collaborator | The project aimed at evaluating diffraction-free Bessel beams to develop a high-resolution microscope |
| Measuring tissue elasticity using Brillouin microscopy | EPSRC - Pathways to Impact Award | ~100k | 2015 | Collaborator | The project validated Brillouin microscopy as a tool for measuring plaque stiffness in atherosclerotic plaques |

Patents

- **Antonacci, G.**, Device and method for the spectroscopic analysis of scattered light, US Patent 17/288,035
- **Antonacci, G.**, An arrangement for enhancing the spectral contrast in a VIPA spectrometer, US Patent 11/060,915
- Leonetti, M. **Antonacci, G.**, Ceccarelli, R., Scattering-assisted super-localization microscopy method and relative apparatus, US Patent 17/040,301

Invited Talks

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|-----------|--|
| June 2022 | <i>Italian Conference on Optics and Photonics</i> , Trento (Plenary Session invited speaker) |
| May 2022 | <i>Istituto Fondazione di Oncologia Molecolare (IFOM)</i> , invited seminar (Host: Prof Scita) |
| Mar 2022 | <i>CNR – IFN</i> , invited seminar (Host: Dr Vanna) |
| Dec 2021 | <i>Università degli Studi Roma Tre</i> , invited seminar (Host: Prof. Cincotti) |
| Mar 2021 | <i>Università Campus Bio-Medico di Roma</i> , invited seminar (Host: Prof. Iannello) |
| Oct 2020 | <i>SciX 2020 Conference</i> , Sparks (invited talk, suppressed due to Covid-19 outbreak) |
| May 2019 | <i>Politecnico di Milano</i> , invited seminar (Host: Prof. Polli) |
| Feb 2019 | <i>University California Davis</i> , invited seminar (Host: Prof. Koski) |
| Sept 2018 | <i>Vienna BioCenter</i> , invited seminar (Host: Dr. Elsayad) |
| Jul 2018 | <i>Ghent University</i> , invited seminar (Host: Prof. Baets) |
| Apr 2018 | <i>European Laboratory for Non-linear Spectroscopy</i> , invited seminar (Host: Prof. Pavone) |
| Mar 2018 | <i>International Conference on BioMedical Photonics</i> , Montpellier (invited speaker) |
| Jul 2017 | <i>8th International Meeting on Relaxations in Complex Systems</i> , Wisla (invited speaker) |
| Jul 2016 | <i>Photonics 2016</i> , Berlin (invited speaker and moderator) |
| Jun 2015 | <i>Sapienza University of Rome</i> , invited seminar (Host: Prof. Ruocco) |
| Feb 2015 | <i>The Post Internazionale</i> , invited talk (Host: Giulio Gambino) |
| Mar 2014 | <i>Imperial College London</i> , invited seminar (Host: Prof. Török) |

Other Selected Presentations

| | |
|---------------|--|
| May 2022 | <i>European Conference on Integrated Optics (ECIO)</i> , Milan |
| Feb 2022 | <i>Integrated Optics: Devices, Materials, and Technologies– Photonics West</i> , San Francisco |
| Feb 2020 | <i>Silicon Photonics - Photonics West</i> , San Francisco |
| Feb 2020 | <i>Label-free Biomedical Imaging and Sensing - Photonics West</i> , San Francisco |
| Feb 2014-2019 | <i>Optical Elastography and Tissue - Photonics West</i> , San Francisco |
| Mar 2017 | <i>Focus on Microscopy</i> , Bordeaux |
| May 2017 | <i>CLEO Conference on Lasers and Electro-Optics</i> , San Jose |
| Mar 2015 | <i>Optics in Cardiology</i> , Rotterdam |
| Sept 2014 | <i>Photonics14</i> , London |
| Mar 2013 | <i>Focus on Microscopy</i> , Maastricht |
| May 2013 | <i>European Conferences in Biomedical Optics (ECBO)</i> , Munich |

Curriculum Vitae et Studiorum

May 2022

Luca Bursi, PhD

Institute for Nanoscience, National Research Council, CNR-NANO-S3,
via Campi 213/A, 41125, Modena, Italy

PERSONAL INFORMATION

Nationality: Italian

RESEARCH EXPERIENCE

- Aug. 2020 – Current: **Senior Postdoctoral Researcher**
Institute for Nanoscience, CNR-NANO-S3, via Campi 213/A, 41125, Modena, Italy
First Principles DFT, Complex Systems, Devices Modeling (INTERSECT EU project)
Advisor: Dr. Arrigo Calzolari
- Aug. 2020 – Jul. 2021: **Visiting Scholar** on *Catalysis on solvated interfaces*
Department of Physics, University of North Texas (UNT), Denton, TX 76203, USA
Advisor: Prof. Oliviero Andreussi
- May 2019 – Jul. 2020: **Postdoctoral Research Associate**
Department of Physics, University of North Texas (UNT), Denton, TX 76203, USA
Theoretical Quantum Optics and Implicit Solvation Schemes for Condensed Matter
Advisor: Prof. Oliviero Andreussi
- May 2017 – May 2019: **Postdoctoral Research Associate**
Department of Physics and Astronomy & Laboratory for Nanophotonics,
Rice University, 6100 Main St., Houston, TX 77005, USA
Theoretical Quantum and Classical Plasmonics and Nanophotonics
Advisor: Prof. Peter Nordlander
- Oct. 2015 – Feb. 2016: **Visiting Scholar** on *Theoretical Nanophotonics*
Laboratory for Nanophotonics, Rice University, Houston, TX 77005, USA
Advisor: Prof. Peter Nordlander
- Jan. 2014 – Mar. 2017: **PhD student**
Department of Physics, Informatics and Mathematics, University of Modena and Reggio Emilia & Institute for Nanoscience, CNR-NANO-S3, Modena, Italy
Theoretical Quantum Nanoplasmonics, Condensed Matter Physics
Advisors: Prof. Stefano Corni, Dr. Arrigo Calzolari, Prof. Elisa Molinari

EDUCATION

- Mar. 2017: **PhD in Physics and Nano Sciences** (cum Laude)
Department of Physics, Informatics and Mathematics, University of Modena and Reggio Emilia & Institute for Nanoscience, CNR-NANO-S3, Modena, Italy
Thesis: Quantifying the plasmonic character of optical excitations at the nanoscale
Advisors: Prof. Stefano Corni, Dr. Arrigo Calzolari, Prof. Elisa Molinari
- Oct. 2013: **MSc in Physics** (cum Laude)
University of Modena and Reggio Emilia, Modena, Italy
Thesis: π -conjugated carbon-based nanosystems: optical excitations and size-effects
Advisors: Dr. Arrigo Calzolari, Prof. Stefano Corni, Prof. Elisa Molinari

- Oct. 2010: **BSc in Physics** (cum Laude)
University of Modena and Reggio Emilia, Modena, Italy
Thesis: First principles investigation of the Cu(111) surface
Advisors: Dr. Carlo Cavazzoni, Prof. Giorgio Santoro
- May 2010: **Visiting Student** (May – Jul. 2010)
CINECA Supercomputing Center, Bologna, Italy
Computational Condensed Matter Physics, MPI/OpenMP Parallel Computing
Advisor: Dr. Carlo Cavazzoni

RESEARCH INTEREST

My research interest involves the investigation of electronic and optical properties of solid state materials, nanostructures and molecular assemblies, using state-of-the-art *ab initio* density-functional theory (DFT), time-dependent DFT, and beyond; modeling catalytic and electrochemical processes on solvated interfaces by means of state-of-the-art implicit solvation schemes for DFT-based condensed matter simulations; and computational modeling of plasmonic nanostructures through advanced electromagnetic simulation techniques.

Currently, my activity focuses on the development, testing and application of first principles simulations and high-throughput workflows for the study of defective and/or complex systems (e.g., disordered, polycrystalline, amorphous, etc.), in order to improve the modeling and understanding of next-generation devices for synaptic electronics and neuromorphic computing, as part of the European project INTERSECT.

GRANTS AWARDED

- Dec. 2018: 2018 Innovative Collaborative Grant Award
Department of Nanomedicine, Houston Methodist & Rice University
Project entitled: *Implantable continuous-mode device for early-stage detection and treatment of inflammation state caused by any implanted foreign body*
- 2013 – 2018: 5 ISCRA Grants for supercomputing resources (4 as PI; 1 as Co-PI)
- 2021 – ongoing: 1 ISCRA Grant for supercomputing resources as PI

SCIENTIFIC PUBLICATIONS AND COMMUNICATIONS

Coauthor of 13 publications on international peer-reviewed journals (2 as first author). Citations: 319 on Google Scholar, 245 on Scopus; h-index: 9 on Google Scholar, 8 on Scopus (May 11th 2022). Author ID on ORCID: <http://orcid.org/0000-0002-4530-0424>. Author ID on Scopus: 56575141100. Scientific communications include 2 seminars; 10 oral and 13 poster contributions and participation in 20 international conferences; plus 4 oral and 4 poster contributions accepted in 3 international conferences then cancelled in 2020.

BRIEF DESCRIPTION OF RESEARCH ACTIVITY

My research activity focused, during my master thesis and PhD at the **University of Modena and Reggio Emilia and Italian Institute of Nanoscience, CNR-NANO-S3, Modena, Italy**, and under the joint supervision of Prof. Stefano Corni, Dr. Arrigo Calzolari and Prof. Elisa Molinari, on the introduction, development and implementation of original microscopic approaches specifically designed to **quantify the plasmonic character of optical excitations in (small) nanostructures**. This involved both the reformulation at the microscopic level of existing concepts, such as the plasmonic electric field enhancement [1], and the introduction of new descriptors, based on rigorous theoretical derivations, called plasmonicity indexes [3,4]. Such approaches provide simple and physically sound tools for

the identification of plasmon-like excitations, starting from the simulations of the optical properties of nanosystems. The plasmonicity indexes have been implemented in atomistic *first principles* methods based on time-dependent density-functional theory (TDDFT) [3], spherical jellium descriptions of nanoparticles, and Classical Electrodynamics [4]. They have been applied to analyze the plasmonic behavior of metallic and semiconductor nanoclusters, prototypical C-based molecules, paradigmatic hybrid systems, as well as nanospheres described within the jellium model and larger nanoparticles modeled through classical electrodynamics [3,4]. I performed the first principles DFT and TDDFT simulations on the systems studied with Quantum Espresso (QE) and GAMESS computer codes and I coded the plasmonicity indexes approaches as homemade parallel post-processing tools that exploit directly the outputs of QE and GAMESS. In particular, Ref. [4] was the result of an international collaboration among a few pioneering groups in “quantum” nanoplasmonics: Prof. P. Nordlander’s group at Rice University, Houston, TX, U.S.A., which I visited during my PhD, Prof. F. J. García de Abajo’s group at ICFO, Barcelona Institute of Science and Technology, Barcelona, Spain, E. A. Carter’s group at Princeton University, Princeton, NJ, U.S.A., and my supervisors and me at the University of Modena and Reggio Emilia and CNR-NANO-S3, Modena, Italy.

I continued working on the identification of plasmonic excitations in molecular and ultra-small nanostructures during my postdoc in **Prof. Peter Nordlander’s group** at Rice University, Houston, TX, USA. In collaboration with Prof. Naomi J. Halas’ experimental group, also at Rice University, the **excited-states decay dynamics of molecular plasmons in selected polycyclic aromatic hydrocarbons**, both in their charged and neutral configurations, have been probed with special emphasis on the de-excitation pathways, and we theoretically investigated their collective character [5,10]. I performed the first principles DFT and TDDFT simulations mainly with GAUSSIAN and GAMESS computer codes.

At the same time, under the supervision of Prof. Nordlander and in collaboration with Prof. Alessandro Alabastri and Prof. Stephan Link’s group at Rice University, I used finite element method (FEM) electromagnetic simulations, as implemented in the commercial software COMSOL Multiphysics, to model the **chiroptical response of individual nanoantennas to the polarization states achievable in surface waves**. More specifically, we observed giant modulation of the visible light scattering from gold half-ring and pinwheel nanoantennas excited through total internal reflection of left- and right-handed circularly polarized light, by exploiting the distinct polarization properties of evanescent waves [6]. Such polarization properties were shown to be required for obtaining intense polarization-dependent responses and the FEM electromagnetic simulations agreed very well with experimental measurements. These results provide a fundamentally different mechanism for chiroptical responses requiring a phase delay between transverse and longitudinal electric field oscillations, not found in free-space light, whereas traditional mechanisms of circular dichroism only require structural sensitivity to a relative phase difference between transverse-field oscillations. We then investigated such mechanism more fundamentally when we demonstrated matter’s inherent sensitivity to the direction of the trochoidal field and named this property **trochoidal dichroism** [9]. We observed trochoidal dichroism in the differential excitation of bonding and antibonding plasmon modes for a system composed of two coupled dipole scatterers. Trochoidal dichroism constitutes the observation of a geometric basis for polarization sensitivity that fundamentally differs from linear and circular dichroism. It could also be used to characterize molecular systems, such as certain light-harvesting antennas, with cartwheeling charge motion upon excitation.

I also contributed to two projects, in collaboration with Prof. Halas’ group at Rice University, where the **bottom-up growths of Al nanocrystals and nanocubes essentially controlled by the choice of the reaction solvent** together with reaction time and temperature were presented [7,8]. In particular, I calculated the first principles optical absorption spectra, at the TDDFT level, of several Ti–Al compounds in different (implicit) solvents, by means of QE and GAUSSIAN codes, which, together with other independent theoretical simulations, supported the experimental finding and conclusions.

More specifically, through careful analysis of the colloidal synthesis of Al nanocrystals (NCRs) through EPR and ^1H NMR spectroscopies, a mechanism for the reactions by which **titanium(IV) isopropoxide $\text{Ti}(\text{OiPr})_4$ mediates the polymerization of AlH_3 into Al NCRs** has been elucidated, on the one hand. AlH_3 is a single-source precursor for Al metal with hydride oxidation into H_2 , catalyzed by $\text{Ti}^{3+}(\text{OiPr})_3$, providing the electrons required to produce metallic Al clusters. These clusters are colloiddally unstable and coalesce and grow until they reach sufficiently large size to become colloiddally stable. This essentially demonstrates a method to tune the size of metallic aluminum NCRs over a 100 nm range by changing the reaction solvent [7].

On the other hand, by decomposing AlH_3 with Tebbe's reagent in tetrahydrofuran, single-crystalline {100} terminated Al nanocubes (NCUs) straightforward colloidal synthesis has been achieved. **The size and shape of the Al NCUs is controlled by the reaction time and the ratio of AlH_3 to Tebbe's reagent**, which, together with reaction temperature, establish kinetic control over Al NCU growth. Al NCUs possess strong localized field enhancements at their sharp corners and resonances highly amenable to coupling with metallic substrates. Their native oxide surface renders them extremely air stable. Chemically synthesized Al NCUs provide an earth-abundant alternative to noble metal NCUs for plasmonics and nanophotonics applications [8].

During my postdoc in **Prof. Oliviero Andreussi's group** at the University of North Texas, Denton, TX, USA, I exploited the state-of-the-art multiscale continuum embedding schemes for first principles condensed matter simulations, as implemented in the Environ plugin of the QE suite of codes, to model catalytical and electrochemical processes on solvated interfaces. I focused, on the one hand, on the **solvation effects in the oxygen evolution reaction (OER) on a promising catalyst such as TiO_2** , whose microscopic mechanism has recently been subject of extensive research. On the other hand, I contributed to the investigation, simulation and **screening of catalytic activities, performances and properties of a database of candidate two-dimensional (2D) materials for OER and oxygen reduction reaction (ORR)** by means of homemade systematic high-throughput workflows exploiting accurate computational thermodynamic approaches, based on first-principles simulations [12].

As a "Senior" postdoc in **Dr. Arrigo Calzolari's group** at the Italian Institute of Nanoscience, CNR-NANO-S3, Modena, Italy I am focusing on the **development**, testing and **application** of scientific computing approaches and **first principles simulations high-throughput workflows** (e.g. based on AiiDA), and on the design and application of multi-scale simulations based on finite element methods and continuous models (e.g. COMSOL Multiphysics) for the study of complex systems (e.g. **defective**, disordered, polycrystalline, **amorphous**, nanostructured, etc.) in order to understand the fundamental operational mechanisms and successfully model devices for synaptic electronics, neuromorphic computation, and more, as part of the European project INTERSECT (PI: Dr. Calzolari).

In collaboration with José Vidal-Gancedo's group at the Institut de Ciència de Materials de Barcelona, ICMA-B-CSIC, Spain, we studied the anchoring of active organic radicals on gold nanoparticles (AuNPs) surface in the context of molecular spintronic devices [13]. In particular, we report the first demonstration of a **surface molecular switch based on AuNPs decorated with persistent perchlorotriphenylmethyl (PTM) radicals**. The redox properties of PTM are exploited to fabricate electrochemical switches with optical and magnetic responses, showing high stability and reversibility. Electronic interaction between the radicals and the gold surface is investigated by UV-vis, showing a very broad absorption band in the near-infrared (NIR) region, which becomes more intense when PTMs are reduced to anionic phase. By using multiple experimental techniques, we demonstrate that this interaction is likely favored by the preferentially flat orientation of PTM ligands on the metallic NP surface, as confirmed by first principles simulations.

PUBLICATIONS LIST

- [13] V. Lloveras, P. Elías-Rodríguez, L. Bursi, E. Shirdel, A. R. Goñi, A. Calzolari, J. Vidal-Gancedo. Multifunctional Switch Based on Spin-Labeled Gold Nanoparticles. *Nano Lett.*, **22** (2), 768–774 (2022). <https://doi.org/10.1021/acs.nanolett.1c04294>.
- [12] N. Karmodak, L. Bursi, O. Andreussi. Oxygen evolution and reduction on two-dimensional transition metal dichalcogenides. *J. Phys. Chem. Lett.*, **13** (1), 58–65 (2022). <https://doi.org/10.1021/acs.jpcllett.1c03431>.
- [11] S. S. E. Collins, E. K. Searles, L. J. Tauzin, M. Lou, L. Bursi, Y. Liu, J. Song, C. Flatebo, R. Baiyasi, Y.-Y. Cai, B. Foerster, T. Lian, P. Nordlander, S. Link, C. F. Landes. Plasmon energy transfer in hybrid nanoantennas. *ACS Nano*, **15** (6), 9522–9530 (2021). <https://doi.org/10.1021/acs.nano.0c08982>.
- [10] K. D. Chapkin, L. Bursi, B. D. Clark, G. Wu, A. Lauchner, A.-L. Tsai, P. Nordlander, N. J. Halas. Effects of electronic structure on molecular plasmon dynamics. *J. Phys. Chem. C*, **124** (37), 20450–20457 (2020). <https://doi.org/10.1021/acs.jpcc.0c06072>.
- [9] L. A. McCarthy, K. W. Smith, X. Lana, S. A. Hosseini Jebeli, L. Bursi, A. Alabastri, W.-S. Chang, P. Nordlander, S. Link. Polarized evanescent waves reveal trochoidal dichroism. *Proc. Natl. Acad. Sci. USA*, **117** (28), 16143–16148 (2020). <https://doi.org/10.1073/pnas.2004169117>.
- [8] B. D. Clark, C. R. Jacobson, M. Lou, D. Renard, G. Wu, L. Bursi, A. S. Ali, D. F. Swearer, A.-L. Tsai, P. Nordlander, N. J. Halas. Aluminum nanocubes have sharp corners. *ACS Nano*, **13** (8), 9682–9691 (2019). <https://doi.org/10.1021/acs.nano.9b05277>.
- [7] B. D. Clark, C. J. DeSantis, G. Wu, D. Renard, M. J. McClain, L. Bursi, A.-L. Tsai, P. Nordlander, N. J. Halas. Ligand-dependent colloidal stability controls the growth of aluminum nanocrystals. *J. Am. Chem. Soc.*, **141** (4), 1716–1724 (2019). <https://doi.org/10.1021/jacs.8b12255>.
[JACS Spotlights: *J. Am. Chem. Soc.*, **141**, 1393–1393 (2019)].
- [6] K. W. Smith, L. A. McCarthy, A. Alabastri, L. Bursi, W.-S. Chang, P. Nordlander, S. Link. Exploiting evanescent field polarization for giant chiroptical modulation from achiral gold half-rings. *ACS Nano*, **12** (11), 11657–11663 (2018). <https://doi.org/10.1021/acs.nano.8b07060>.
- [5] K. D. Chapkin, L. Bursi, G. J. Stec, A. Lauchner, N. J. Hogan, Y. Cui, P. Nordlander, N. J. Halas. Lifetime dynamics of plasmons in the few-atom limit. *Proc. Natl. Acad. Sci. USA*, **115** (37), 9134–9139 (2018). <https://doi.org/10.1073/pnas.1805357115>.
- [4] R. Zhang, L. Bursi, J. D. Cox, Y. Cui, C. M. Krauter, A. Alabastri, A. Manjavacas, A. Calzolari, S. Corni, E. Molinari, E. A. Carter, F. J. García de Abajo, H. Zhang, P. Nordlander. How to identify plasmons from the optical response of nanostructures. *ACS Nano*, **11** (7), 7321–7335 (2017). <https://doi.org/10.1021/acs.nano.7b03421>.
- [3] L. Bursi, A. Calzolari, S. Corni, E. Molinari. Quantifying the plasmonic character of optical excitations in nanostructures. *ACS Photonics*, **3** (4), 520–525 (2016). <https://doi.org/10.1021/acsphotonics.5b00688>.
- [2] F. J. García de Abajo, R. Sapienza, M. Noginov, F. Benz, J. Baumberg, S. Maier, D. Graham, J. Aizpurua, T. Ebbesen, A. Pinchuk, J. Khurgin, K. Matczyszyn, J. T. Hugall, N. van Hulst, P. Dawson, C. Roberts, M. Nielsen, L. Bursi, M. Flatté, J. Yi, O. Hess, N. Engheta, M. Brongersma, V. Podolskiy, V. Shalaev, E. Narimanov, A. Zayats. Plasmonic and new plasmonic materials: general discussion. *Faraday Discuss.*, **178**, 123–149 (2015). <https://doi.org/10.1039/C5FD90022K>.

- [1] L. Bursi, A. Calzolari, S. Corni, E. Molinari. Light-induced field enhancement in nanoscale systems from first-principles: the case of polyacenes. *ACS Photonics*, **1** (10), 1049–1058 (2014). <https://doi.org/10.1021/ph500269q>.

SELECTED CONTRIBUTIONS IN INTERNATIONAL CONFERENCES

- Mar. 2021 L. Bursi, R. Chouhan, A. Catellani, A. Calzolari. *Formation and Diffusion of Charged and Neural Defect States in Crystalline GeSe for Synaptic Electronics*. **2021 APS March Meeting** (Virtual meeting). Oral Presentation.
- Nov. 2020 L. Bursi, R. Zhang, K. D. Chapkin, N. J. Halas, P. Nordlander. *Universal metric for “plasmonicity” of excitations at the nanoscale*. **2020 Virtual MRS Spring/Fall Meeting & Exhibit** (Virtual meeting). Oral Presentation.
- Jul. 2018 L. Bursi, R. Zhang, K. D. Chapkin, A. Alabastri, N. J. Halas, P. Nordlander. *Universal metric for “plasmonicity” of excitations at the nanoscale*. **Plasmonics and Nanophotonics Gordon Research Conference** (Grand Summit Hotel at Sunday River, Newry, ME, USA). Poster Presentation.
- Aug. 2017 L. Bursi, A. Calzolari, S. Corni, E. Molinari, P. Nordlander. *Towards quantitative Quantum Nanoplasmonics*. **Smalley-Curl Institute 3rd Annual Summer Research Colloquium** (Smalley-Curl Institute, Rice University, Houston, TX 77005, USA). Oral Presentation.
- Aug. 2016 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Quantifying the plasmonic character of optical excitations in nanostructures*. **Quantum Plasmonics (QUPLA) Workshop** (Imperial College London, Royal School of Mines, South Kensington, London, UK). Poster Presentation.

MENTORSHIP AND TEACHING

- 2019 Teaching Assistant (to graduate students) for the Course of Multiphysics Modeling (ESEL 677 002, 26231), ECE Department, Rice University, held by Prof. Alessandro Alabastri (3 credit hours).
- 2016 Teaching Assistant for the Course of Quantum Mechanics, University of Modena and Reggio Emilia, funded by the Italian Government (35 hrs.).
- 2014 – 2015 Teaching Assistant (to undergraduate students) for the Course of Quantum Mechanics, University of Modena and Reggio Emilia (70 hrs.).

COMPUTER SKILLS

Programming: Fortran, Python, Matlab, Pascal, C, C++, shell, parallel MPI and OpenMP paradigms (basic level), linear algebra techniques, data fitting.

Scientific software programs: Quantum ESPRESSO, GAMESS, GAUSSIAN and OCTOPUS (*ab initio* simulations); AiiDA (automated, interactive infrastructure and database for simulations); COMSOL Multiphysics (multi-scale, continuous models-based, and classical electromagnetic simulations); Mathematica, Matlab (numerical calculations); gnuplot, grace, Avogadro, VMD (visualization and numerical analysis); etc.

OTHER MERITS

Referee for: Nature Physics, Nature Communications, ACS Nano, Physical Review X, Nanoscale, Chemical Communications, Applied Clay Science, ACS Applied Nano Materials, Physical Review B, Chemical Physics Letters, Molecules, Catalysts, Materials, Sensors, Coatings, Journal of Physics and Chemistry of Solids, The Journal of Physical Chemistry,

Applied Sciences, Applied Physics A: Materials Science and Processing.

Publons verified records: <https://publons.com/a/1582985>; merit: > **90th percentile**.

Good skills in relationship with other people. Experience in teamwork and collaboration.
Experience in teaching and educational activities with high school and university students.

MEMBERSHIPS

Material Research Society (2020-2021); American Physical Society (2019–2022).
Italian Society of Chemistry (2018–2019); Royal Society of Chemistry (2015–2016).

REFERENCES

- Arrigo Calzolari, Istituto Nanoscienze-CNR-S3, Modena, Italy
- Stefano Corni, University of Padova, Padova, Italy
- Peter Nordlander, Rice University, Houston, TX, USA
- Oliviero Andreussi, University of North Texas, Denton, TX, USA
- Naomi J. Halas, Rice University, Houston, TX, USA
- Elisa Molinari, University of Modena and Reggio Emilia, Italy

Luca Bursi

Additional Information

ISCRA GRANTS FOR SUPERCOMPUTING RESOURCES AWARDED

6. (Nov 2021 – ongoing) PI for the Iskra C project *First principles characterization of defect states in materials, through AiiDA, QE, and NEB, for next-generation technology* (acronym: AiiDAdef) using the HPC systems MARCONI 100 (IBM Power9 AC922 processors, accelerated with NVIDIA Volta V100 GPUs) and GALILEO 100 (Intel CascadeLake processors) at CINECA Supercomputing Center, Bologna, Italy.
5. (Jul 2017 – Apr 2018) Co-PI for the Iskra C project *Studying the 2D and 1D size-dependence of the GPI by scaling the size of PAHs and Na atomic nanowires, in particular their length and aspect ratio, through TurboTDDFT and PlasmInd-GPI, toward comparison with independent jellium model, RPA and Classical Electrodynamics calculations* (acronym: GPI-Q1D) using the HPC system MARCONI Lenovo NeXtScale (Broadwell processors) and MARCONI Lenovo Adam Pass (Knights Landing processors) at CINECA Supercomputing Center, Bologna, Italy.
4. (Aug 2016 – May 2017) PI for the Iskra C project *Studying the 3D, 2D and 1D size-dependence of the Plasmonicity Index by scaling the size of metal nanoclusters, through TurboTDDFT and PlasmInd, toward comparison with independent jellium model analysis* (acronym: ScalPInd) using the HPC system GALILEO IBM NeXtScale and MARCONI Lenovo NeXtScale at CINECA Supercomputing Center, Bologna, Italy.
3. (Oct 2015 – Jul 2016) PI for the Iskra C project *Characterizing plasmonic properties of graphene nanoflakes through TurboTDDFT and PlasmInd for nanoplasmonic applications* (acronym: PInd-GNF) using the HPC system FERMI Blue Gene/Q and GALILEO IBM NeXtScale at CINECA Supercomputing Center, Bologna, Italy.
2. (Oct 2014 – Jul 2015) PI for the Iskra C project *Testing a Plasmonic Index through TurboTDDFT for nanoplasmonics applications* (acronym: PlasmInd) using the HPC system FERMI Blue Gene/Q at CINECA Supercomputing Center, Bologna, Italy.
1. (Feb 2013 – Dec 2013) PI for the Iskra C project *Evaluating performances and scaling of TurboTDDFT for nanoplasmonics applications* (acronym: TDPlasm) using the HPC system FERMI Blue Gene/Q at CINECA Supercomputing Center, Bologna, Italy.

SEMINARS

- Jun. 26, 2017 L. Bursi. *Towards quantitative quantum nanoplasmonics: Strategies to measure the “plasmonicity” of optical excitations in nanostructures.* Smalley-Curl Institute, Rice University, Houston, TX 77005, USA.
- Feb. 1, 2017 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Strategies for the quantification of the plasmonic character of optical excitations in nanostructures.* CNR-Nano colloquia, Center S3, CNR Institute of Nanoscience, University of Modena and Reggio Emilia, Modena, Italy.

INTERNATIONAL CONFERENCES AND WORKSHOPS

- Nov. 2021 L. Bursi, R. K. Chouhan, A. Catellani, A. Calzolari. *Ab initio characterization of defect states in materials for next-generation technology.* **International Workshop on Advanced Materials-to-Device Solutions for Synaptic Electronics** (Barcelona, Spain). Poster Presentation.
- Mar. 2021 L. Bursi, R. K. Chouhan, A. Catellani, A. Calzolari. *Formation and Diffusion of Charged and Neural Defect States in Crystalline GeSe for Synaptic Electronics.* **2021 APS March Meeting** (Virtual meeting). Oral Presentation.

- Mar. 2021 L. Bursi, R. Zhang, K. D. Chapkin, N. J. Halas, P. Nordlander. *Universal metric for “plasmonicity” of excitations at the nanoscale*. **2021 APS March Meeting** (Virtual meeting). Poster Presentation.
- Mar. 2021 L. Bursi, L. A. McCarthy, K. W. Smith, A. Alabastri, W.-S. Chang, P. Nordlander, S. Link. *Evanescent field polarization for giant chiroptical modulation from achiral gold half-rings: Theoretical insight from simulations*. **2021 APS March Meeting** (Virtual meeting). Poster Presentation.
- Nov. 2020 L. Bursi, R. Zhang, K. D. Chapkin, N. J. Halas, P. Nordlander. *Universal metric for “plasmonicity” of excitations at the nanoscale*. **2020 Virtual MRS Spring/Fall Meeting & Exhibit** (Virtual meeting). Oral Presentation.
- Nov. 2020 L. Bursi, L. A. McCarthy, K. W. Smith, A. Alabastri, W.-S. Chang, P. Nordlander, S. Link. *Evanescent field polarization for giant chiroptical modulation from achiral gold half-rings: Theoretical insight from simulations*. **2020 Virtual MRS Spring/Fall Meeting & Exhibit** (Virtual meeting). Oral Presentation.
- Jul. 2019 L. Bursi, R. Zhang, K. D. Chapkin, N. J. Halas, P. Nordlander. *Universal metric for “plasmonicity” of excitations at the nanoscale*. **ESCOMP 2019: Advanced Electronic Structure Methods in Condensed Matter Physics** (EPFL, Lausanne, Switzerland). Poster Presentation.
- Aug. 2018 L. Bursi, R. Zhang, K. D. Chapkin, N. J. Halas, P. Nordlander. *Universal metric for “plasmonicity” of excitations at the nanoscale*. **Smalley-Curl Institute 4th Annual Summer Research Colloquium** (Smalley-Curl Institute, Rice University, Houston, TX 77005, USA). Oral Presentation.
- Jul. 2018 L. Bursi, R. Zhang, K. D. Chapkin, A. Alabastri, N. J. Halas, P. Nordlander. *Universal metric for “plasmonicity” of excitations at the nanoscale*. **Plasmonics and Nanophotonics Gordon Research Conference** (Grand Summit Hotel at Sunday River, Newry, ME, USA). Poster Presentation.
- Aug. 2017 L. Bursi, A. Calzolari, S. Corni, E. Molinari, P. Nordlander. *Towards quantitative Quantum Nanoplasmonics*. **Smalley-Curl Institute 3rd Annual Summer Research Colloquium** (Smalley-Curl Institute, Rice University, Houston, TX 77005, USA). Oral Presentation.
- Aug. 2016 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Quantifying the plasmonic character of optical excitations in nanostructures*. **Quantum Plasmonics (QUPLA) Workshop** (Imperial College London, Royal School of Mines, South Kensington, London, UK). Poster Presentation.
- Jul. 2016 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Towards a quantitative description of the plasmonic character of optical excitations in nanostructures*. **META 2016, the 7th International Conference on Metamaterials, Photonic Crystals and Plasmonics** (Torremolinos, Malaga, Spain). Oral Presentation.
- Jun. 2016 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Light-induced field enhancement in polyacenes*. **SINFO - Surface, Interface and Functionalization Processes in Organic Compounds and Applications - 3rd Workshop** (University Federico II of Naples, Italy). Poster Presentation.
- Apr. 2016 Participation in the **Nanostructured Metal Optics: from Theory to Enhanced Spectroscopies, Sensing, Imaging Workshop** (Scuola Normale di Pisa, Italy).

- Jul. 2015 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Quantifying the plasmonic character of optical excitations in nanostructures from first principles*. **Plasmonica 2015 Workshop** (University of Padua, Italy). Oral Presentation.
- Mar. 2015 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Light-induced field enhancement in polyacenes*. **DPG Spring Meeting** (Technische Universitaet, Berlin, Germany). Oral Presentation.
- Feb. 2015 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Light-induced field enhancement in polyacenes*. **Nanomaterials for Applications in Energy Technology Gordon Research Conference** (Ventura Beach Marriott, Ventura, CA, USA). Poster Presentation.
- Feb. 2015 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Light-induced field enhancement in polyacenes*. **Nanomaterials for Applications in Energy Technology Gordon Research Seminar** (Ventura Beach Marriott, Ventura, CA, USA). Poster Presentation.
- Feb. 2015 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Light-induced field enhancement in polyacenes*. **Nanomaterials for Applications in Energy Technology Gordon Research Seminar** (Ventura Beach Marriott, Ventura, CA, USA). Oral Presentation.
- Feb. 2015 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Light-induced field enhancement in polyacenes*. **Faraday Discussion 178: Nanoplasmonics** (Royal Society of Chemistry at Burlington House and Geological Society, London, UK). Poster Presentation.
- Jan. 2015 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Light-induced field enhancement in polyacenes*. **International Workshop on Computational Physics and Materials Science: Total Energy and Force Methods** (International Centre for Theoretical Physics, Trieste, Italy). Poster Presentation.
- Jul. 2014 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Light-induced field enhancement in polyacenes*. **Plasmonica 2014 Workshop** (University of Rome Sapienza, Italy). Poster Presentation.
- Jun. 2014 L. Bursi, A. Calzolari, S. Corni, E. Molinari. *Light-induced field enhancement in polyacenes*. **SINFO - Surface, Interface and Functionalization Processes in Organic Compounds and Applications - 2nd Workshop** (University of Trieste, Italy). Oral Presentation.
- Nov. 2013 Participation in the **Conference on Frontiers of Condensed Matter Physics** (International Centre for Theoretical Physics, Trieste, Italy).

SCIENTIFIC SCHOOLS

- Jun. 2014 ICOE 2014 School on Predictive Modelling and Computational Methods for Organic Electronics (University of Modena and Reggio Emilia, Italy).
- Mar. 2013 Introduction to the FERMI Blue Gene/Q for users and developers (CINECA Supercomputing center, Bologna, Italy).
- Aug. 2012 HoW exciting! Hands-on Workshop on Excitations in Solids 2012 (Humboldt Universitaet zu Berlin, Germany).
- Jun. 2010 Summer School on Parallel Computing (CINECA Supercomputing center, Bologna, Italy).
- Jun. 2010 Introduction to the Blue Gene/P for users and developers (CINECA Supercomputing center, Bologna, Italy).

CV del Ricercatore

Generalità ed Attuale Affiliazione

IST Austria | Lemeshko group | Ricercatore Post-doc

A partire dal 01/02/2021

Am Campus 1, Klosterneuburg 3400, Austria

Precedenti Posizioni Accademiche

01/10/2018 - 31/12/2020 **Ricercatore Post-dottorato Junior**

Dipartimento di Fisica ed Astronomia “G. Galilei”

Università degli Studi di Padova

Via Marzolo 8, Padova 35131, Italia

Formazione

Ph.D in Fisica / Cum Laude

01/10/2015 - 30/09/2018

Dipartimento di Fisica ed Astronomia “G. Galilei”

Università degli Studi di Padova

Tesi: “*Ultracold quantum gases: beyond-mean-field equations of state*”

Data della Difesa: 12/12/2018

Supervisor: Prof. Luca Salasnich

Crediti formativi per la professione di insegnante della scuola secondaria

15/01/2018 - 30/04/2018

24 CFU in Pedagogia della didattica inclusiva, psicologia dell'apprendimento motivato, antropologia culturale e filosofica e metodi per la didattica della Fisica

Laurea magistrale in Fisica / 110/110 Cum Laude

08/01/2013 - 12/12/2014

Dipartimento di Fisica ed Astronomia “G. Galilei”

Università degli Studi di Padova

Tesi: “*Out-of-equilibrium quasi-stationary states in ultracold atomic gases*”

Relatore: Prof. Luca Salasnich

Correlatori: Prof. E. Orlandini & Prof. F. Baldovin

Laurea in Fisica / 99/110

10/09/2009 - 14/12/2012

Dipartimento di Fisica ed Astronomia “G. Galilei”,

Università degli Studi di Padova

Tesi: “*Macroscopic Quantum Tunneling with BEC: analytical and numerical results*”

Relatore: Prof. Luca Salasnich

1. A. Tononi, [A. Cappellaro](#), G. Bighin and L. Salasnich,
Phys. Rev. A **103**, L061303 (2021) [arXiv:2009.06491](#)
Propagation of first and second sound in a two-dimensional Fermi superfluid
2. [A. Cappellaro](#) and L. Salasnich,
Scientific Reports **10**, 9088 (2020) [arXiv:2005.04932](#)
Shift of the critical temperature in superconductors: a self-consistent approach
3. A. Tononi, F. Toigo, S. M. Wimberger, [A. Cappellaro](#) and L. Salasnich,
New J. Phys. **22**, 073020 (2020) [arXiv:2003.11056](#)
Dephasing-rephasing dynamics of one-dimensional tunneling quasicondensates
4. [A. Cappellaro](#) and L. Salasnich,
Phys. Rev. A **101**, 053628 (2020) [arXiv:2004.14635](#)
Effective field theory of bosons with finite-range interaction in a disordered environment
5. F. De Bettin, [A. Cappellaro](#) and L. Salasnich,
Condens. Matt. **4**, 81 (2019) [arXiv:1909.03694](#)
Action Functional for a Particle with Damping
6. [A. Cappellaro](#) and L. Salasnich,
Appl. Sci. **9**, 1498 (2019) [arXiv:1904.04168](#)
Superfluids, Fluctuations and Disorder
7. A. Tononi, [A. Cappellaro](#) and L. Salasnich,
New J. Phys. **20**, 125007 (2018) [arXiv:1812.02996](#)
Condensation and superfluidity of dilute Bose gases with finite-range interaction
8. [A. Cappellaro](#), F. Toigo and L. Salasnich,
Phys. Rev. A **98**, 043605 (2018) [arXiv:1807.02541](#)
Collisionless dynamics in two-dimensional Bose gases
9. [A. Cappellaro](#), T. Macrí and L. Salasnich,
Phys. Rev. A **97**, 053623 (2018) [arXiv:1805.05730](#)
Collective modes across the soliton-droplet crossover in binary Bose mixtures
10. [A. Cappellaro](#) and L. Salasnich,
Phys. Rev. A **96**, 063610 (2017) [arXiv:1711.11362](#)
Finite-range corrections to the thermodynamics of the one-dimensional Bose gas
11. F. Cinti, [A. Cappellaro](#), T. Macrí and L. Salasnich,
Phys. Rev. Lett. **119**, 215302 (2017) [arXiv:1610.03119](#)
Superfluid Filaments of dipolar bosons in free space
12. [A. Cappellaro](#), T. Macrí, G. F. Bertacco, L. Salasnich,

Scientific Reports 7, 13358 (2017) [arXiv:1705.01814](#)
Equation of state and self-bound droplet in Rabi-coupled Bose mixtures

13. [A. Cappellaro](#), L. Salasnich,
Phys. Rev. A **95**, 033627 (2017) [arXiv:1702.01401](#)
Thermal field theory of bosonic gases with finite-range effective interaction

14. F. Baldovin, [A. Cappellaro](#), E. Orlandini and L. Salasnich,
J. Stat. Mech., 063303 (2016) [arXiv:1605.02220](#) (based on M.Sc. Thesis)
Nonequilibrium statistical mechanics in one-dimensional bose gases

Seminari, Conferenze, Scuole

Superfluctuations 2021 (Conferenza Online)

14/06/2021 - 16/06/2021

Seminario Registrato: “*Sound propagation in two-dimensional Fermi gases*”
Università di Padova e Università di Camerino, Italia

Seminario - Gruppo di Teoria della Materia Condensata

22/09/2020

Talk su invito: “*Sound propagation in two-dimensional atomic systems*”
Technion, Haifa, Israele

Superfluctuations 2020 (Conferenza Online)

22/06/2020 - 23/06/2020

Seminario Registrato: “*Shift of the critical temperature in superconductors*”
Università di Padova e Università di Camerino, Italia

Spring Online Workshop on Ultracold Quantum Matter

04/06/2020

Invited Speaker: “*Shift of the critical temperature in superconductors*”
Università di Padova e Università di Firenze, Italia

Seminario - Dipartimento di Fisica dei Materiali

10/02/2020

Talk su invito: “*The droplet phase in binary Bose mixtures*”
Universidad Complutense, Madrid, Spagna

Superfluctuations 2019 (Conferenza Online)

02/09/2019 - 04/09/2019

Membro del comitato organizzatore locale
Organizzato da Università di Padova ed Università di Camerino
Padova, Italia

INT-19-1a Program. Quantum Turbulence: Cold Atoms, Heavy Ions and Neutron Stars

16/03/2019 - 04/04/2019

Talk su invito: “*Two-dimensional atomic gases: BKT transition and collisionless dynamics*”

Institute of Nuclear Theory (INT), University of Washington, Seattle, USA

Superfluctuations 2018

05/09/2018 - 07/09/2018

Talk su invito: “*The droplet phase in binary Bose mixtures*”
Università di Camerino, S. Benedetto del Tronto, Italia

ICAP Summer School & ICAP 2018

16/07/2018 - 27/07/2018

Poster: “*The droplet phases in dipolar and Rabi-coupled condensates*”

Palau du Congressos, Barcelona, Spagna

Workshop. Long-Range Interactions with Ultracold Atoms (parallel event of the international conference Topological States of Matter)

11/11/2016 - 22/11/2016

Talk su invito: “*Beyond-mean-field and finite-range effects in ultracold atomic bosons*”

International Institute of Physics (IIP), Natal, Brazil

Didattica

Docente (24 ore), Fisica Generale - Meccanica & Elettromagnetismo

01/03/2020 - 31/07/2020

Corso di Laurea Triennale in Ingegneria Meccatronica,
Corso di Laurea Triennale in Ingegneria dell’Innovazione del Prodotto
Università degli Studi di Padova, Italia

Didattica di Supporto (16 ore), Laboratorio di Fisica - Meccanica

01/05/2020 - 31/07/2020

Attività online di avviamento alla fisica sperimentale
Corso di Laurea Triennale in Ingegneria (percorso comune)
Università degli Studi di Padova, Italia

Docente (4 ore), Introduction to the Ginzburg-Landau formalism for the superconducting transition

01/01/2020 - 31/01/2020

Corso di Dottorato in Fisica,
Università degli Studi di Padova, Italia

Didattica di Supporto (16 ore), Fisica Sperimentale II - Elettromagnetismo (Esercitazione)

01/10/2019 - 31/12/2019

Corso di Laurea Triennale in Ottica & optometria,
Università degli Studi di Padova, Italia

Didattica di Supporto (32 ore), Laboratorio di Fisica - Meccanica & Elettromagnetismo

26/04/2019 - 27/07/2019

Corso di Laurea Triennale in Ingegneria Meccatronica,
Corso di Laurea Triennale in Ingegneria dell’Innovazione del Prodotto
Università degli Studi di Padova, Italia

Didattica di Supporto (40 ore), Laboratorio di Fisica - Meccanica, Elettromagnetismo & Ottica

06/10/2018 - 08/01/2019

Corso di Laurea Triennale in Ingegneria (percorso comune)
Università degli Studi di Padova, Italia

Premi & Fellowship

IST Postdoctoral Fellowship

Institute of Science and Technology (IST Austria)
Am Campus 1, Klosterneuburg 3400, Austria
(Acceptance rate 10 - 15%)

Marie Curie Postdoctoral fellowship - Reserve List

Call: HORIZON-MSCA-2021-PF-01
ID del Progetto: 101062862/NeqMolRot
Nome Progetto: “*Non-Equilibrium Field Theory of Molecular Rotations*”
Valutazione: 91.20%
(Funding threshold 92.20% - Seal of Excellence a 85%)

ÖAW (Austrian Academy of Sciences) APART-MINT Fellowship

Award Meeting: 25/04/2022 - Data di inizio 01/11/2022 (12 + 6 Mesi)
ID del Progetto: 11980
Nome Progetto: “*Non-equilibrium Molecular Rotations in Fermionic Environments*”

Attività di Divulgazione (Outreach)

Sei Spritz Facili.

26/04/2017

Talk divulgativo per studenti triennali: “*Atomi in frigorifero: esplorare la Fisica delle Bassissime Temperature*”

Dipartimento di Fisica ed Astronomia “G. Galilei”,
Università degli Studi di Padova

La Fisica dei Sistemi Complessi: da Padova al Resto del Mondo.

21/12/2016

Talk divulgativo: “*Dipolar self-bound superfluid droplets*”

Dipartimento di Fisica ed Astronomia “G. Galilei”,
Università degli Studi di Padova

International School of Physics “E. Fermi”. C198 - Quantum Simulators

22/07/2016 - 27/07/2016

Seminario Flash: “*The complicated sentimental life of a boson*”
Varenna, Italy

Incarichi Editoriali

Referee.

Journal of Physics B: Atomic, Molecular and Optical Physics (IOP)
New Journal of Physics (IOP)
Journal of Optics (IOP)
Journal of Physics Communications (IOP)
SciPost Physics (SciPost)
Condensed Matter (MDPI)

CURRICULUM VITAE

Main research topics

-Twisted graphene bilayer and moiré Physics:

The recent discovery of superconductivity and insulating states at integer filling in small-angle twisted bilayer graphene by the group of Pablo Jarillo-Herrero in 2018 generated a renewed interest in the study of the moiré materials. The exotic phase diagrams observed in many moiré systems make them a paradigmatic platform for studying strongly correlated electronic behaviors, as well as the role of the electron-phonon coupling. Dr. Cea investigated theoretically many aspects of the twisted bilayer graphene, as the role of the Coulomb repulsion, the effects of the heterostrain and/or the substrate, the mechanism at the origin of superconductivity, etc.

-Elastic properties of atomic membranes:

Dr. Cea investigated the theory of the elastic membranes applied to physical systems with atomic thickness, focusing mainly on the cases of hexagonal boron nitride (hBN) and graphene. In particular, for the case of hBN, Dr. Cea studied the role of the strain in the piezoelectric effect, providing the theoretical support for the experimental research lead by the group of KS Novoselov in the University of Manchester (P. Ares et al, Advanced Materials 2020). This work has shown that localized regions with large strain in a membrane of hBN can generate a sizable electric field, making hBN able to convert mechanical into electric energy.

-Collective modes and dynamical features in superconductors:

The loss of the charge conservation in a superconductor comes along with the breaking of the continuum $U(1)$ symmetry, leading to the presence of two collective modes: the Goldstone mode describing the phase fluctuations of the superconducting order parameter, and the massive mode associated to its amplitude fluctuations, also called the

Schmid or Higgs mode. During his master and PhD studies, Dr. Cea investigated the dynamics of these two modes and the possibility of tracing experimentally their signatures by means of spectroscopic probes. Dr. Cea showed that these modes are very elusive, as they weakly couple to any external probe. At the same time, Dr. Cea studied the systems and the experimental conditions in which the phase and/or the amplitude mode can become optically active and consequently leave a spectroscopic signature. The analysis lead by Dr. Cea in this field refers to peculiar experimental techniques exploiting the light-matter interaction, in particular: the Raman spectroscopy and the third harmonic generation by means of the THz pump-probe excitation protocol.

Keywords

Quantum Field Theory at finite temperature, Many body techniques, Linear response theory, Strongly correlated electrons, Superconductivity, Bloch band theory, 2D Materials, Mean field techniques, Numerical techniques

Education

Dr. Cea graduated **2012** at the Università di Roma La Sapienza, with full marks and honors, under the supervision of Prof. Claudio Castellani, with the master thesis: “Strongly disordered superconductors in proximity of the superconductor-insulator transition”.

Dr. Cea spent the academic year **2012/2013** at the International School for Advanced Studies, SISSA, in Trieste, where he got a three years PhD scholarship.

In **2013** Dr. Cea got a three years PhD scholarship at the Università di Roma La Sapienza, in Rome, where he moved and obtained the PhD with full marks and honors in February, **2017**, under the supervision of Profs. Claudio Castellani and Lara Benfatto, with the PhD thesis: “Unconventional dynamics and spectroscopy in superconductors”.

During the doctoral studies Dr. Cea studied theoretically the emergent properties related to the quantum dynamics and spectroscopy in superconducting systems.

In **2017** Dr. Cea was a postdoctoral researcher at the Università di Roma La Sapienza, under the supervision of Prof. Francesco Mauri, with the project: “Studio teorico dei modi di membrana e delle proprietà termodinamiche associate nel grafene”, founded by the European Graphene Flagship.

From September **2017** to June **2020** Dr. Cea was a postdoctoral researcher at the Instituto Madrilenio des Estudios Avanzados IMDEA Nanociencia, in Madrid, Spain, under the supervision of Prof. Francisco Guinea, with the project: “Emerging properties of new materials”, founded by the European Graphene Flagship.

From July **2020** to March 2021 Dr. was a postdoctoral researcher at the Instituto de Ciencia de Materiales de Madrid ICMM, CSIS, in Madrid, Spain, under the supervision of Prof. Pilar Lopez Sancho, with the project: “Emerging properties of new materials”, in collaboration with Prof. Francisco Guinea.

At present Dr. Cea is a postdoctoral researcher at the Instituto Madrilenio des Estudios Avanzados IMDEA Nanociencia, in Madrid, Spain.

Bibliometric indices

H index: 14 (Scopus), 16 (Google Scholar)
Citations: 538 (Scopus), 802 (Google Scholar)

Grants and awards

Team projects

- European Graphene Flagship, Core 2, Grant No. 785219. Project: *“Graphene based technologies: development of numerical modeling methods”*
- European Graphene Flagship, Core 3, Grant No. 881603. Project: *“Graphene based technologies: development of numerical modeling methods”*
- NEMAT2D-CM. Project: *“New bi-dimensional materials: characterizations, properties and applications”*

Awards

- *“Junior Presentation Honorable Mention”* at the conference LEES 2021

Publications

1. L. Benfatto, C. Castellani, T. Cea, *“Comment on: Calculation of an Enhanced Alg Symmetry Mode induced by Higgs Oscillations in the Raman Spectrum of High-Temperature Cuprate Superconductors”*, arXiv:2203.01804 (2022)
2. U. Aseginolaza, T. Cea, R. Bianco, L. Monacelli, M. Calandra, A. Bergara, F. Mauri, I. Errea, *“Quadratic flexural acoustic phonons and in-plane sound propagation in graphene”*, arXiv:2005.12047 (2020)
3. F. Giorgianni, M. Udina, T. Cea, E. Paris, M. Caputo, M. Radovic, L. Boie, J. Sakai, C. W. Schneider, S. L. Johnson, *“Terahertz displacive excitation of a coherent Raman-active phonon in V_2O_3 ”*, arXiv:2203.03656 (2022), accepted in Communication Physics
4. V. Crépel, T. Cea, L. Fu, F. Guinea, *“Unconventional superconductivity due to interband polarization”*, Physical Review B, **105** (9), 094506 (2022). **Editor’s Suggestion**

5. M. Udina, J. Fiore, T. Cea, C. Castellani, G. Seibold, L. Benfatto, “*THz non-linear optical response in cuprates: predominance of the BCS response over the Higgs mode*”, Faraday Discuss. (2022)
6. T. Cea, P. A. Pantaleon, V. T. Phong, F. Guinea, “*Superconductivity from Repulsive Interactions in Rhombohedral Trilayer Graphene: a Kohn-Luttinger-Like Mechanism*”, Physical Review B, **105**, 075432 (2022)
7. T. Cea, P. A. Pantaleon, N. R. Walet, F. Guinea, “*Electrostatic interactions in twisted bilayer graphene*”, Nano Materials Science, 2589-9651 (2021)
8. V. T. Phong, P. A. Pantaleon, T. Cea, F. Guinea, “*Band structure and superconductivity in twisted trilayer graphene*”, Physical Review B, **104** (12), 121116 (2021)
9. H. Sainz-Cruz, T. Cea, P. A. Pantaleon, F. Guinea, “*High transmission in twisted bilayer graphene with angle disorder*”, Physical Review B, **104** (7), 075144 (2021)
10. T. Cea, F. Guinea, “*Coulomb interactions, phonons, and superconductivity in twisted bilayer graphene*”, Proceedings of the National Academy of Sciences of the United States of America, **118** (32) e2107874118 (2021)
11. P. A. Pantaleon, T. Cea, R. Brown, N. R. Walet, F. Guinea, “*Narrow bands and electrostatic interactions in graphene stacks*”, 2D Materials, **8** (4), 044006 (2021)
12. L. Chirulli, T. Cea, F. Giazotto, “*Impact of electrostatic fields in layered crystalline BCS superconductors*”, Physical Review Research, **3** (2), 023135 (2021)
13. F. Meslpe, A. Missaoui, T. Cea, L. Huder, G. Trambly de Laissadière, F. Guinea, C. Chapelier, V. T. Renard, “*Heterostrain rules the flat-bands in magic-angle twisted bilayer graphene*”, Physical Review Letters, **127** (12), 126405 (2021)

14. T. Cea, P. A. Pantaleon, F. Guinea, “*Band structure of twisted bilayer graphene on hexagonal boron nitride*”, Phys. Rev. B **102** (15), 155136 (2020)
15. T. Cea, M. Ruiz-García, L. L. Bonilla, F. Guinea, “*Numerical study of the rippling instability driven by electron-phonon coupling in graphene*”, Phys. Rev. B **101** (23), 235428 (2020)
16. T. Cea, F. Guinea, “*Band structure and insulating states driven by the Coulomb interaction in twisted bilayer graphene*”, Phys. Rev. B **102** (4), 045107 (2020)
17. P. Ares, T. Cea, M. Holwill, Y. B. Wang, R. Roldán, F. Guinea, D. V. Andreeva, L. Fumagalli, K. S. Novoselov, C. R. Woods, “*Piezoelectricity in monolayer hexagonal boron nitride*”, Advanced Materials **32** (1), 1905504 (2020)
18. T. Cea, N. R. Walet, F. Guinea, “*Twists and the electronic structure of graphitic materials*”, Nano Letters **19** (12), 8683-8689 (2019)
19. T. Cea, N. R. Walet, F. Guinea, “*Electronic bandwidth and pinning of Fermi energy to van Hove singularities in twisted bilayer graphene: a self consistent approach*”, Phys. Rev. B **100** (20), 205113 (2019)
20. F. Giorgianni, U. Puc, M. Jazbinsek, T. Cea, M. J. Koo, J. H. Han, O. P. Kwon, C. Vicario, “*Supercontinuum generation in OHQ-N2S organic crystal driven by intense terahertz fields*”, Optics Letters **44** (19), 4881-4884 (2019)
21. M. Udina, T. Cea, L. Benfatto, “*Theory of coherent oscillations detection in THz pump-probe spectroscopy: from phonons to electronic collective modes*”, Phys. Rev. B **100** (16), 165131 (2019)
22. F. Giorgianni, T. Cea, C. Vicario, C. P. Hauri, W. K. Withanage, X. Xi, L. Benfatto, “*Leggett mode controlled by light*”, Nature Physics **15** (4), 341-346 (2019)

23. T. Cea, P. Barone, C. Castellani, L. Benfatto, “*Polarization dependence of the third-harmonic generation in multiband superconductors*”, Phys. Rev. B **97** (9) 094516 (2018)
24. R. Grasset, T. Cea, Y. Gallais, M. Cazayous, A. Sacuto, L. Cario, L. Benfatto, M.A. Méasson, “*Higgs mode radiance and charge-density-wave order in 2H-NbSe₂*”, Phys. Rev. B **97** (9) 094502 (2018)
25. U. Pracht, T. Cea, N. Bachar, G. Deutscher, E. Färber, M. Dressel, M. Scheffler, C. Castellani, A. M. Garcia-Garcia, L. Benfatto, “*Optical signatures of the superconducting Goldstone mode in granular aluminum: experiments and theory*”, Phys. Rev. B. **96** (9) 094514 (2017)
26. T. Cea, L. Benfatto, “*Signature of the Leggett mode in the A_{1g} Raman response: From MgB₂ to iron-based superconductors*”, Phys. Rev. B **94** (6), 064512 (2016)
27. T. Cea, L. Benfatto, C. Castellani, “*Non-linear optical effects and third-harmonic generation in superconductors: Cooper-pairs vs Higgs mode contribution*” Phys. Rev. B **93** (18), 180507(R) (2016)
28. T. Cea, C. Castellani, G. Seibold, L. Benfatto, “*Nonrelativistic dynamics of the amplitude (Higgs) mode in superconductors*” Phys. Rev. Lett. **115** (15), 157002 (2015)
29. T. Cea, L. Benfatto, “*Nature and Raman signatures of the Higgs amplitude mode in the coexisting superconducting and charge-density-wave state*” Phys. Rev. B **90** (22), 224515 (2014)
30. T. Cea, D. Bucheli, G. Seibold, L. Benfatto, C. Castellani, “*Optical excitation of phase modes in strongly disordered superconductors*” Phys. Rev. B **89** (17), 174506 (2014)

Conferences and contributions:

- “Novel Electronic Properties of 2D Materials”, to be held in San Sebastian, Spain on July 11-15th 2022. **Invited talk**
- Theory seminar at Università di Roma La Sapienza (Italy), 14/12/2021. **Invited talk**: “Coulomb interaction, correlations and superconductivity in twisted bilayer graphene”
- Seminar at IMDEA Nanoscience, Madrid (Spain), 16/11/2021. **Invited talk**: “Coulomb interaction, correlations and superconductivity in twisted bilayer graphene”
- “LEES 2020 - Low-energy electrodynamics in solids”, online, 28/06/2021-01/07/2021. **Invited talk**: “Coulomb interaction, phonons, and superconductivity in twisted bilayer graphene”
- “APS March Meeting”, online, 15/03/2021-19/03/2021. Oral presentation: “Plasmons, phonons and superconductivity in twisted bilayer graphene”
- Theory Seminars at the Department of Physics and Astronomy, of the University of Manchester (UK), 01/07/2020. **Invited talk**: “Band structure and insulating states driven by the Coulomb interaction in twisted bilayer graphene”
- “CMD2020GEFES”, Madrid (Spain), 31/08/2020-04/09/2020. Oral presentation: “Band structure and insulating states driven by the Coulomb interaction in twisted bilayer graphene”
- Summer school: “Driving the Road Towards Room Temperature Superconductivity with Electronic Interactions”, Miraflores de La Sierra, Madrid (Spain), 08/09/2019-13/09/2019. Poster+oral presentation: “Twists and the Electronic Structure of Graphitic Materials”
- “Italian National Conference on the Physics of Matter”, Trieste (Italy) 01/10/2017-06/10/2017. Oral presentation: “Thz Pump+Probe spectroscopy in NbN superconductor”
- “Spectroscopies in Novel Superconductors”, Ludwigsburg, Stuttgart (Germany) 19/06/2016-24/06/2016. Poster: “Nature and Raman

signatures of the Higgs amplitude mode in the coexisting superconducting and charge-density-wave state”

- “Ugo Fano-Symposium and gold medal ceremony”, Rome (Italy) 17/12/2015-18/12/2015. Oral presentation: "Nature and Raman signatures of the Higgs amplitude mode in the coexisting superconducting and charge-density-wave state”
- “Probing and Understanding Exotic Superconductors and Superfluids”, Trieste (Italy) 27/10/2014-31/10/2014. Oral presentation: "Nature and Raman signatures of the Higgs amplitude mode in the coexisting superconducting and charge-density-wave state”
- “Superconductivity and Functional Oxides”, Rome (Italy) 24/09/2014-26/09/2014. Poster: “Optical excitation of phase modes in strongly disordered superconductors”

Laura Fanfarillo, Ph.D.

Curriculum Vitae

Trieste, September 29 2021

General Information

Full name: Laura Fanfarillo
Date and place of birth: 20/11/1984 Rome
Citizenship: italian
Orcid-ID: 0000-0002-6452-8520
Spoken Languages: italian, english, spanish

Education

- 07/02/2013 **Ph.D. in Physics**, “Sapienza” University of Rome, Italy. Thesis: *Transport properties in multichannel systems*, under the supervision of Dr. L. Benfatto, Prof. C. Castellani
- 26/02/2009 **MSci. in Physics** with full marks and honor, “Sapienza” University of Rome, Italy. Thesis: *Paraconductivity in multiband systems*, under the supervision of Prof. M. Grilli, Prof. S. Caprara
- 23/11/2006 **B.A. in Physics** with full marks and honor, “Sapienza” University of Rome, Italy. Thesis: *Rotational Brownian Motion: from Einstein theory to dielectric relaxation*, under the supervision of Prof. M. Falcioni, Dr. M. Valli

Appointments

- 09/2019-09/2022 **RTD-A**, at SISSA International School for Advanced Studies, Trieste, Italy.
MSCA-IF Global Fellow Outgoing phase at UF, University of Florida, Gainesville, FL-USA. Return phase at SISSA International School for Advanced Studies, Trieste, Italy. Faculty Advisors: P.J. Hirschfeld, M. Capone.
- 07/2015–06/2019 **Post-doctoral Researcher** at SISSA, International School for Advanced Studies, Trieste, Italy. Faculty Advisor: M. Capone
- 11/2012–06/2015 **Post-doctoral Researcher** at ICMM-CSIC, Instituto de Ciencia de Materiales de Madrid, Madrid, Spain. Faculty Advisors: E. Bascones, B. Valenzuela

Qualifications

- 01/2022 **Abilitazione Scientifica Nazionale** Associate Professor in Theoretical physics of matter (02/B2). Issued by the Italian Ministry of university and research (Ministero dell’Università e della Ricerca) - Qualified until 2031.
- 02/2019 **Maître de conférences** in Condensed matter and Materials. Issued by the French Ministry of advanced studies, research and innovation (Ministère de l’Enseignement supérieur, de la Recherche et de l’Innovation) - Qualified until 2023

Professional Development

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|--------------------------------|---|
| Teaching Training | Creative and Authentic Assessments UF Center for Teaching Excellence workshop, University of Florida, 3/02/2022 |
| | Focused Introduction to Facilitating Equitable Faculty Searches UF Center for Teaching Excellence workshop, University of Florida, 18/02/2022 |
| | Collaborative Learning Techniques UF Center for Teaching Excellence workshop, University of Florida, 10/02/2022 |
| | Making Meetings Work UF Center for Teaching Excellence workshop, University of Florida, 27/01/2022 |
| | Building a Classroom Community UF Center for Teaching Excellence workshop, University of Florida, 26/01/2022 |
| | Curriculum Internazionalization UF Center for Teaching Excellence workshop, University of Florida, 24/01/2022 |
| | Motivation - Ideas to Transform Your Lecture UF Center for Teaching Excellence workshop, University of Florida, 19/01/2022 |
| | Inclusive Teaching Strategies: Awareness and Reflection UF Center for Teaching Excellence workshop, University of Florida, 18/01/2022 |
| Soft Skill Training | Mentoring and Being Mentored , Learn-Discover-Lead seminar series University of Florida, 14/01/2022. |
| | Effective Listening Skills , Learn-Discover-Lead seminar series, University of Florida, 10/12/2021. |
| | Team Dynamics and Leading Teams , Learn-Discover-Lead seminar series, University of Florida, 12/11/2021. |
| | Leadership In Science , Learn-Discover-Lead seminar series , University of Florida, 14/02/2020. |
| | Minibootcamp on proposal writing for H2020 MSCA-IF , AREA Science Park 2-day training, Trieste (Italy) 7/2018. |
| Visiting | Science Dialogues - Creative science communication , Sissa Medialab 20h training, Trieste (Italy), 12/2017 |
| | University of Tennessee , scientific collaboration hosted by S. Johnston, Knoxville (TN,USA), January 10 – 15, 2022 |
| | Niels Bohr Institute , scientific collaboration hosted by B.M. Andersen, Copenhagen (Denmark), October 12 – November 5, 2020. |
| International Workshops | KITP Program 2022 Experimental and Theoretical search for Pair-Density-Wave Order, Santa Barbara (CA, Usa), May 9 – 20, 2022. |
| | KITP Program 2017 Intertwined Order and Fluctuations in Quantum Materials, Santa Barbara (CA, Usa), September 11 – 29, 2017. |

CMP in the City 2016 Condensed Matter Physics Program, London (UK), July 4 – 8, 2016

KITP Program 2014 Magnetism, Bad Metals and Superconductivity, Santa Barbara (CA, Usa), October 13 – 31, 2014

International Schools **ICTP 2015** *Strongly Correlated Electronic Systems – Novel Materials and Novel Theories*, Trieste (Italy), August 10 – 21, 2015.

BOULDER School for Condensed Matter and Materials 2014 *Modern Aspects of Superconductivity*, Boulder (CO, Usa), June 30 – July 25, 2014.

ICAM STEP 2013 *Summer School on Superconductivity – Theory, Experiments, and Phenomena*, Cargese (France), August 5– 17, 2013.

ICTP 2012, *Innovations in Strongly Correlated Electronic Systems*, Trieste (Italy), August 6 –17 , 2012.

ICAM MULTIORB 2011, *Summer School on Multiband and Multiorbital Effect in Novel Materials*, Cargese (France), August 1 – 13, 2011.

ICMP School 2010 *ICTS School of the Condensed Matter Programme 2010*, Mysore (India), December 12 – 23, 2010.

Teaching Experience

Supervision **PhD program** Raquel Fernández, *Orbital Selective Spin-Fluctuations Physics in Iron-based superconductors*, UAM - Autonomous University of Madrid, 7/2021.

Master student Tancredi Salomone, *Electronic correlations and multiorbital effects in superconducting systems*, “Sapienza” University of Rome, 3/2019.

PhD program Maja Berovic, *Exploring Hund’s correlated metals: charge instabilities and effect of selective interactions*, SISSA, Trieste 10/2018.

Master student Alberto Scazzola, *Magnetism and symmetry broken phases in strongly correlated electron models*, University of Trieste 10/2018.

Master student Sebastiano Belli, *Two-orbitals cold atoms in optical lattice: a strong-coupling approach analysis*, University of Trieste 3/2018.

Teaching **The Slave-Spin Method**, guest lectures Ph.D program SISSA (3h) 12/2017.

The Fermi-liquid Theory, guest lectures ICMM-CSIC (3h) 3/2015.

Society memberships, Awards and Honors

2020- **Grete Hermann Network** member. GHN is a female researchers global network associated to the Wurzburg-Dresden Cluster of Excellence “Complexity and Topology in Quantum Matter“ funded within Germany’s Excellence Strategy.

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| 2019 | Honorable mention "L'Oréal for Women in Science" national program 2018/2019. 6 fellowship to fund italian women researcher under 35 y.o. working on Life sciences or in the fields of Physical sciences, Mathematics and Computer science. Project evaluated among the top 10 proposals submitted. |
| 2016 | ICAM Junior travel award to attend the CMP in the City 2016 Summer Program. |
| 2011- | European Physical Society member |

Funding Information

| | |
|----------------------------|---|
| Individual grants | <p>H2020-MSCA-IF Global 2018 <i>SuperCoop – Unconventional Superconductivity and Strong Electronic Correlations: a Cooperative mechanism</i>, Grant Agreement 8385261 – 210.000 euro</p> <p>Perfezionamento "Sapienza" 2013 <i>Role of the orbital and magnetic degrees of freedom in iron-based superconductors</i>, "Sapienza" University of Rome fellowship for one year of scientific training in a foreign country – 15.500 euro</p> |
| Project team member | <p>University of Florida project grant, <i>Data Science for Discovery in Chemical and Materials Sciences</i>, 2018, PIs: P.J. Hirschfeld, J. Hamlin, DE-SC-0020385, funded by US-Department of Energy (DOE) .</p> <p>Italian national project grant PRIN 2015 <i>Controlling Multi-band Quantum Materials by Orbital Manipulation</i>, 2017-2020, PI: M. Capone, Prot.2015C5SEJJ001, funded by Ministero dell'Istruzione, Università e Ricerca (MIUR)</p> <p>Fundación Ramón Areces 2015, <i>High temperature superconductivity in iron superconductors</i>, 2015-2018, PI: E. Bascones, funded by Fundación Ramón Areces</p> <p>Spanish national project grant 2014, <i>Electronic correlations and topology in multiorbital systems</i>, 2015-2018, Ref.FIS2014-53219-P, PIs: B. Valenzuela, E. Bascones, funded by Ministerio de Economía y Competitividad</p> <p>Spanish national project grant 2011, <i>Electronic properties of iron superconductors</i>, 2012-2015, Ref.FIS2011-29689, PI: E. Bascones, funded by Ministerio de Educacion y Ciencia</p> |

Dissemination Activity

About 20 poster presented at international meeting. 33 oral contributions, in particular: 9 invited and 11 contributed talks at international conferences (1 keynote talk), 13 invited seminars at research institutions (3 colloquia).

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|----------------------|--|
| Invited Talks | <p>(I9) SuperTop 2019, <i>Synergy between Hund-driven correlations and boson-mediated Superconductivity</i>, Rome (Italy), September 4, 2019</p> <p>(I8) M2S 2018, <i>Nematicity and Superconductivity in FeSe</i>, Beijing (China), August 24, 2018</p> |
|----------------------|--|

(I7) **SuperTop 2018**, *Hund's Physics: exploring the phase diagram of iron-based superconductors*, Rome (Italy), June 22, 2018

(I6) **Complex Quantum Matter 2018**, *Hund's Physics in the nematic and superconducting phases of FeSe*, Rome (Italy), June 12, 2018

(I5) **ETSF-YRM 2018**, *Emergence of quantum phases in Condensed Matter: Strongly Correlated Electrons, Magnetism and Topology*, Hamburg (Germany), June 5, 2018. (keynote talk)

(I4) **MultiSuper 2018**, *Nematicity and Superconductivity in FeSe*, Trieste (Italy), May 14, 2018.

(I3) **SuperFluctuations 2017**, *Orbital Selectivity in the nematic phase of Iron-based Superconductors: strong and weak-correlated perspectives*, San Benedetto del Tronto (Italy), September 7, 2017

(I2) **Superstripes 2017**, *Orbital Selectivity in the nematic phase of Iron-based Superconductors: strong and weak-correlated perspectives*, Ischia (Italy), June 9, 2017

(I1) **NGSCES 2016**, *Orbital Selectivity and Hund's Physics in Iron-based Superconductors*, Trieste (Italy), September 30, 2016

Contributed Talks

(C11) **MarchMeeting 2022**, *Hallmarks of nematicity in the spectral weight redistribution of Hund's metals*, Chicago (USA), March 18, 2022

(C10) **MarchMeeting 2021**, *Microscopic mechanism for fluctuating pair-density-wave*, Online meeting, March 17, 2021

(C9) **MarchMeeting 2020**, *Unconventional superconductivity and Hund's induced electron correlations: a Cooperative mechanism*, Denver (CO, USA), March 2, 2020 (canceled due Covid-19, presentation available on MM APS webpage)

(C8) **ParisEdge 2017**, *Orbital Selectivity and Hund's physics in the nematic phase of Iron-based Superconductors*, Paris (France), October 17, 2017

(C7) **SCES 2017**, *Orbital Selectivity and Hund's physics in Iron-based materials*, Prague (Czech Republic), July 21, 2017

(C6) **What about U? 2016**, *Hund's Physics in Iron-based Superconductors*, Trieste (Italy), October 21, 2016

(C5) **SuperFOx 2016**, *The role of Hund's coupling in the nematicity of Iron Superconductors*, Turin (Italy), September 30, 2016

(C4) **CMP in the City 2016**, *Hund's physics in Iron-based Superconductors*, London (UK), July 8, 2016

(C3) **SuperFOx 2014**, *Microscopic nematicity in iron superconductors coupling of the spin/orbital degrees of freedom and topology*, Rome (Italy), September 25, 2014

(C2) **NGSCES 2013**, *Unconventional Hall effect in pnictides*, Sestri Levante (Italy), July 2, 2013

(C1) **SuperFOx 2012**, *Unconventional Hall effect in pnictides from interband interactions*, Como (Italy), June 20, 2012.

**Invited
Seminars**

(S13) *Theoretical approaches to study emergent phenomena in correlated systems*, **SISSA**, Trieste (Italy), March 12, 2021. (**colloquium**)

(S12) *Superconductivity in bad metals*, **NIB University of Copenhagen**, Copenhagen (Denmark), October 23, 2020.

(S11) *Hund-driven correlations and boson-mediated superconductivity*, **UF University of Florida**, Gainesville (FL, Usa), September 16, 2019.

(S10) *Electronic correlations in iron-based superconductors: nematicity and superconductivity*, **Jozef Stefan Institute**, Ljubljana (Slovenia), April 17, 2019

(S9) *Modeling Complexity: Theoretical Approaches to multiorbital correlated systems*, **CSU Long Beach**, Long Beach (CA, Usa), October 1, 2018. (**colloquium**)

(S8) *Modeling Complexity: Theoretical Approaches to multiorbital correlated systems*, **UF University of Florida**, Gainesville (FL, Usa), February 12, 2018. (**colloquium**)

(S7) *Hund's Physics in Hole-doped Iron-Based Superconductors*, **IFW**, Dresden (Germany), January 19, 2018

(S6) *Orbital Selectivity of Iron-Based Superconductors: a strong and weak-correlated perspective*, **KITP**, Santa Barbara (CA, Usa), September 28, 2017

(S5) *Orbital Selective Physics of Iron Superconductors emerging from strong and weak-correlated approaches*, **ICMM-CSIC**, Madrid (Spain), May 30, 2017

(S4) *Spin-orbital interplay and topology in the nematic phase of iron pnictides*, **ICMM-CSIC**, Madrid (Spain), January 15, 2015

(S3) *Spin-orbital interplay and topology in the nematic phase of iron pnictides*, **CSU Long Beach**, Long Beach (CA, Usa), October 31, 2014

(S2) *Current-current Fermi-liquid in underdoped cuprates*, **KIT**, Karlsruhe (Germany), April 11, 2013

(S1) *Transport properties in multichannel systems*, **ICMM-CSIC**, Madrid (Spain), November 29, 2012

Publications

- Metric** 25 publications (23 in WoS database, 2 waiting to be listed)
Total Citations: 445 (WoS), 635 (google scholar)
Hirsch (H) index: 11 (WoS), 12 (google scholar)
- Submitted** (P25) L. Fanfarillo, A. Valli, M. Capone, *Nematic spectral signatures of the Hund's metal*, arXiv:2203.01273
- (P24) L. Fanfarillo, C. Setty, P.J. Hirschfeld, *Microscopic mechanism for fluctuating pair density wave*, arXiv:2110.13138
- Published** (P23) S.R. Xie, Y. Quan, A. Hire, , B. Deng, J.M. DeStefano, I. Salinas, U.S. Shah, L. Fanfarillo, J. Lim, J. Kim, G.R. Stewart, J.J. Hamlin, P.J. Hirschfeld, R.G. Hennig, *Machine learning of superconducting critical temperature from Eliashberg theory*, npj Computational Materials **8**, 1 (2022)
- (P22) S.R. Xie, Y. Quan, A. Hire, L. Fanfarillo, G.R. Stewart, J.J. Hamlin, R.G. Hennig, P.J. Hirschfeld, *Towards high-throughput superconductor discovery via machine learning*, contribution to “The 2021 Room-Temperature Superconductivity Roadmap”, Journal of Physics: Condensed Matter (2021)
- (P21) R. Fernandez-Martin, M.J. Calderón, L. Fanfarillo, B. Valenzuela, *The role of orbital nesting in the superconductivity of Iron-based Superconductors*, Condensed Matter **6**, 34 (2021)
- (P20) J. Lim, A.C. Hire, Y. Quan, J. Kim, L. Fanfarillo, S.R. Xie, R.S. Kumar, C. Park, R.J. Hemley, Y.K. Vohra, R.G. Hennig, P.J. Hirschfeld, G.R. Stewart, J.J. Hamlin, *High-pressure study of the low-Z rich superconductor Be₂₂Re*, Physical Review B **104**, 064505 (2021)
- (P19) L. Fanfarillo, D. Kopic, A. Sterzi, G. Manzoni, A. Crepaldi, D.T. Payne, W. Bronsch, V. Tsurkan, D. Croitori, J. Deisenhofer, F. Parmigiani, M. Capone, F. Cilento, *Photoinduced long-lived state in FeSe_{0.4}Te_{0.6}* Journal of Electron Spectroscopy and Related Phenomena **250**, 147090 (2021)
- (P18) L. Fanfarillo, J.J. Hamlin, R. G. Hennig, A.C. Hire, P.J. Hirschfeld, J. Kim, J. Lim, Y. Quan, G.R. Stewart, S.R. Xie, *Remarkable low-energy properties of the pseudogapped semimetal Be₅Pt*, Phys. Rev. B **102**, 155206 (2020)
- (P17) L. Fanfarillo, A. Valli, M. Capone, *Synergy between Hund-driven correlations and boson-mediated superconductivity*, Phys. Rev. Lett. **125**, 177001 (2020)
- (P16) S. Bhattacharyya, K. Bjornson, K. Zantout, D. Steffensen, L. Fanfarillo, A. Kreisel, R. Valenti, B.M. Andersen, P.J. Hirschfeld, *Nonlocal correlations in iron pnictides and chalcogenides*, Phys. Rev. B **102**, 035109 (2020)
- (P15) A. Isidori, M. Berovic, L. Fanfarillo, L. de'Medici, M. Fabrizio, M. Capone, *Charge disproportionation, mixed valence, and Janus effect in multiorbital systems: A tale of two insulators*, Phys. Rev. Lett. **122**, 186401 (2019)

- (P14) R. Fernandez-Martin, L. Fanfarillo, L. Benfatto, B. Valenzuela, *Anisotropy of the dc conductivity due to orbital-selective spin fluctuations in the nematic phase of iron superconductors*, Phys. Rev. B **99**, 155117 (2019)
- (P13) L. Benfatto, B. Valenzuela, L. Fanfarillo, *Nematic Pairing from Orbital Selective Spin Fluctuations in FeSe*, npj Quantum material **3**, 56 (2018)
- (P12) L. Fanfarillo, L. Benfatto, B. Valenzuela, *Orbital mismatch boosting nematic instability in iron-based superconductors*, Phys. Rev. B **97**, 121109(R) (2018)
- (P11) A. Ronchi, P. Franceschini, L. Fanfarillo, P. Homm, M. Menghini, S. Peli, G. Ferrini, F. Banfi, F. Cilento, A. Damascelli, F. Parmigiani, J-P Locquet, M. Fabrizio, M. Capone and C. Giannetti, *Ultrafast orbital manipulation and Mott physics in multi-band correlated materials*, Proc. SPIE **10530**, 105300V (2018)
- (P10) L. Fanfarillo, G. Giovannetti, M. Capone and E. Bascones, *Nematicity at the Hund's metal crossover in iron superconductors*, Phys. Rev. B **95**, 144511 (2017)
- (P9) L. Fanfarillo, J. Mansart, P. Toulemonde, H. Cercellier, P. Le Fevre, F. Bertran, B. Valenzuela, L. Benfatto, V. Brouet, *Orbital-dependent Fermi Surface shrinking as a fingerprint of nematicity in FeSe*, Phys. Rev. B **94**, 155138 (2016)
- (P8) L. Fanfarillo, M. Mori, M. Campetella, M. Grilli, S. Caprara, *Glue function of optimally and overdoped cuprates from inversion of the Raman spectra*, Journal of Physics: Condensed Matter **28**, 065701 (2016)
- (P7) L. Fanfarillo and E. Bascones, *Electronic correlations in Hund metals*, Phys. Rev. B **92**, 075136 (2015)
- (P6) L. Fanfarillo, A. Cortijo, B. Valenzuela, *Spin-orbital interplay and topology in the nematic phase of iron pnictides*, Phys. Rev. B **91**, 214515 (2015)
- (P5) L. Fanfarillo, L. Benfatto, *Anisotropy of the superconducting fluctuations in multiband superconductors: the case of LiFeAs*, Supercond. Sci. Technol. **27**, 124009 (2014)
- (P4) M. Marciani, L. Fanfarillo, C. Castellani, L. Benfatto, *Legget modes in Fe-based superconductors as a probe of Time Reversal Symmetry Breaking*, Phys. Rev. B **88**, 214508 (2013)
- (P3) L. Fanfarillo, E. Cappelluti, C. Castellani, L. Benfatto, *Unconventional Hall Effect in Pnictides from Interband Interactions*, Phys. Rev. Lett. **109** 096402 (2012)
- (P2) L. Fanfarillo, L. Benfatto, C. Castellani, *Current-current Fermi-liquid corrections to the superconducting fluctuations on conductivity and diamagnetism*, Phys. Rev. B. **85** 024507 (2012)
- (P1) L. Fanfarillo, L. Benfatto, S. Caprara, C. Castellani and M. Grilli, *Theory of fluctuation conductivity from interband pairing in pnictide superconductors*, Phys. Rev. B. **79** 172508 (2009)

Professional and Community Services

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|------------------------|--|
| Reviewer | <p>Referee activity for Physical Review Letters, Physical Review B, Physical Review Materials, Physical Review Research, New Journal of Physics, Europhysics Letters, Nature Communication, Communications Physics, Solid State Communications and African Review of Physics (since 2013, 47 verified reviews on Publons).</p> <p>Referee and PhD Committee member of Jose Maria Pizarro Blanco, Universidad Autonoma de Madrid, Madrid, Spain, 5/2019.</p> |
| Editorial Roles | <p>Guest Associate Editor Research topic <i>Nematicity in Iron-Based Superconductors</i>, Frontiers in Condensed Matter Physics MDPI (ISSN 2296-424X, IF 2020: 3.560) www.frontiersin.org/research-topics/23323/nematicity-in-iron-based-superconductors#</p> |
| Outreach | <p>Organizer Electricity, magnetism and superconductivity exhibition at the Cade Museum, Gainesville 11/2020 (canceled due to Covid-19).</p> <p>Public engagement activities (1) UN Women and Girls in Science Day at UF, Gainesville 2020; (2) SISSA for School, Trieste (in italian), 2017–2019; (3) Week of Science at ICM, Madrid (in spanish), 2012–2015.</p> <p>Popular seminars</p> <ul style="list-style-type: none">-<i>Metalli cattivi con superpoteri</i>, general audience talk about strongly correlated superconductors, European Researchers' Night 2021, Trieste (Italy) 24/09/2021-<i>Superconduttori</i>, introduction to superconductivity for general audience organized by FrascatiScienza, Grottaferrata (Italy) 31/3/2012- <i>100 anni di Superconduttività</i>, general audience talk for the official launch of the issue Accastampato 8 dedicated to superconductivity, Rome (Italy) 12/2/2012 <p>Popular articles <i>Cento anni, ma non li dimostra</i>, Accastampato 8, www.accastampato.it, (english version available at my webpage).</p> |
| Media Coverage | <p>Broadcast interview on superconductors and applications, <i>Road to ESOF2020: smart cities</i>, Radio in corso, podcast available at www.radioincorso.it, June 28, 2019 (in italian).</p> <p>Published interview on the MSCA-IF preparation, <i>La preparazione di una proposta vincitrice di una borsa individuale MSCA</i>, SiS-FVG newsletter, www.sisfvg.it, 3/2019 (in italian).</p> <p>Broadcast interview Sissa Fast-Track 2017 advertisement film by SISSA Medialab company, available at www.youtube.com/SISSAschool (in english).</p> |
| Volunteering | <p>Italian Volunteer Teacher at ICS Onlus, Italian Courses for Refugees A1/A2 levels 2015–2017.</p> |

Researcher Profile

Condensed matter physicist with special interest in the theoretical analysis of anomalous properties and novel states of the matter emerging from the cooperative/competitive interplay between many (orbital, charge, spin) degrees of freedom at different energy scales.

Methodology & Techniques – Solid experience with both analytical methods of quantum many-body physics and quantum-field theory and numerical approaches for the theoretical analysis of strongly correlated electron systems.

Keywords – transport, critical phenomena, fluctuations, strongly correlated electron systems, unconventional superconductivity, multiorbital systems, material science.

Brief Summary of research activity – Since the early stage of my career my research focused on theoretical problems connected to the physics of correlated quantum systems, in particular unconventional iron-based superconductors (IBS). The discovery of unconventional high-temperature superconductivity in these systems in 2008 has been one of the most significant breakthroughs in the past decade for condensed-matter physics. In addition to the cuprate superconductors, researchers now had a whole new class of materials exhibiting superconductivity at high temperatures. However, IBS showed immediately important differences with respect to their forerunners. First, while in cuprates the parent compound is an insulating antiferromagnet, the parent compound of IBS is a metal characterized by spin-density wave order. Moreover, IBS are multiband systems: all the five d-orbital of the Fe-atoms contribute to the formation of multiple bands (having both hole or electron character) crossing the Fermi energy. I have led research on the analysis of IBS multiorbital systems from several points of view. I will summarize in what follows my main three contributions to the field.

**Fluctuations and
Transport
Properties in
unconventional
superconductors**

The discovery of IBS triggered a renewed interest into the theoretical understanding of multiband superconductivity. The pairing in these systems originates from the exchange of spin-fluctuations between the hole and electrons band so IBS represented the first example of multiband superconductors with dominant interband interactions. As a consequence the phenomenology of IBS is markedly different from the one found in multiband superconductors with dominant intra-band interactions as the MgB_2 and cannot be simply accounted for by a trivial generalization of the standard theoretical paradigm describing single-band systems. My research contributed to shape our current understanding of the complex phenomenology of multiband interband superconductors. During my Ph.D. at “Sapienza” University of Rome (2009-2012), under the supervision of Claudio Castellani and Lara Benfatto, I established the theoretical framework for the analysis of superconducting fluctuations and transport properties of this class of systems [1, 2, 3, 4]. In particular, I was able to explain a number of unconventional properties of IBS by accounting for the multiband electronic structure and the interband character of the interactions via full gauge-invariant calculations. The expertise acquired in the methods of the effective action derivation also allowed me recently to take part in a project on fluctuating pair density wave (PDW) in anisotropic strongly coupled pairing systems [5]. We study an analytically solvable model to examine possible pairing phases in the strongly coupled regime in the presence of anisotropic interactions. We find below an instability temperature a novel phase where local pair correlations have non-zero center-of-mass momentum, but lack long-range order. Below a critical temperature, such a fluctuating PDW phase can condense either to a uniform d-wave superconductor or the widely postulated PDW phase, with each extending to zero temperature. The mechanism we discussed has realizations in real materials, including cuprates, where the pseudogap phase has been postulated to be a form of incoherent PDW.

- (1) L. Fanfarillo, L. Benfatto, S. Caprara, C. Castellani, and M. Grilli, *Theory of fluctuation conductivity from interband pairing in pnictide superconductors*, Phys. Rev. B **79**, 172508 (2009)
- (2) M. Marciani, L. Fanfarillo, C. Castellani, and L. Benfatto, *Leggett modes in iron-based superconductors as a probe of time-reversal symmetry breaking*, Phys. Rev. B **88**, 214508 (2013)
- (3) L. Fanfarillo and L. Benfatto, *Anisotropy of the superconducting fluctuations in multiband superconductors: the case of LiFeAs* , Sup. Scie.Tech., **27**, 124009 (2014)
- (4) L. Fanfarillo, E. Cappelluti, C. Castellani, and L. Benfatto, *Unconventional Hall effect in pnictides from interband interactions*, Phys. Rev. Lett. **109**, 096402 (2012)
- (5) L. Fanfarillo, C. Setty, P.J. Hirschfeld, *Fluctuating pair-density-wave in anisotropic strongly coupled pairing systems*, submitted (2021)

**A unified
itinerant picture
for Iron-based
Superconductors**

The phenomenology of many IBS can be explained in terms of an itinerant scenario in which all the ordered phases found in the phase diagram (superconductivity, magnetism and nematicity) originate from the exchange of spin-fluctuations between hole and electron pockets. Within this scenario, the band structure seems to completely rule the emergence of the various phases. The success of such a picture as a unified description of IBS has been partly questioned after the discovery of superconductivity in the FeSe. In fact, despite having a similar band structure with respect to the other IBS, FeSe presents a very different phenomenology. Can a unified theoretical description for the various IBS be derived, or is FeSe unique? This is an open question of primary importance, especially considering the fact that FeSe-based systems are the ones exhibiting the highest critical temperature among all the IBS. During my post-doc at the ICMM-CSIC I derived the Orbital Selective Spin-Fluctuation (OSSF) model by projecting the orbital information into a band-based itinerant model [1]. Over the years I used the OSSF model to gain insight into the phenomenology of FeSe and demonstrated that by correctly incorporating the feedback between orbital and spin degrees of freedom, the OSSF model can successfully explain the peculiarity of FeSe phase diagram [2] as well as the experimental orbital-selective features observed in the nematic and superconducting phase [3, 4, 5, 6]. The OSSF model offers a unified scenario to understand the complex phenomenology of FeSe within the same theoretical framework of other IBS, representing a significant advance in the field of high-temperature superconductors.

My personal contribution has been acknowledged by the scientific community with many invitations to talk at top international meetings included the M2S conference 2018 on superconductors and mechanism of superconductivity in Bejin (China), that represents one of the main international conference of the sector. The recent invitation to act as Guest Associate Editor of the Research topic *Nematicity in Iron-Based Superconductors* for Frontiers in Condensed Matter Physics further demonstrates the public recognition I gained as expert in the field.

- (1) L. Fanfarillo, A. Cortijo, and B. Valenzuela, *Spin-orbital interplay and topology in the nematic phase of iron pnictides*, Phys. Rev. B **91**, 214515 (2015)
- (2) L. Fanfarillo, L. Benfatto, and B. Valenzuela, *Orbital mismatch boosting nematic instability in iron-based superconductors*, Phys. Rev. B **97**, 121109 (2018)
- (3) L. Fanfarillo, J. Mansart, P. Toulemonde, H. Cercellier, P. Le Fèvre, F. Bertran, B. Valenzuela, L. Benfatto, and V. Brouet, *Orbital-dependent Fermi Surface shrinking as a fingerprint of nematicity in FeSe*, Phys. Rev. B **94**, 155138 (2016)
- (4) L. Benfatto, B. Valenzuela, and L. Fanfarillo, *Nematic pairing from orbital-selective spin fluctuations in FeSe*, npj Quantum Materials **3**, 56 (2018)
- (5) R. Fernandez-Martin, L. Fanfarillo, L. Benfatto, B. Valenzuela, *Anisotropy of the dc conductivity due to orbital-selective spin fluctuations in the nematic phase of iron superconductors*, Phys. Rev. B **99**, 155117 (2019)
- (6) R. Fernandez-Martin, M.J. Calderón, L. Fanfarillo*, B. Valenzuela, *The role of orbital nesting in the superconductivity of Iron-based Superconductors*, Condensed Matter **6**, 34 (2021) *corresponding author (invited article)

**Mott and
Hund's physics in
unconventional
superconductors**

Strong electronic interactions in quantum matter lead to the emergence of unusual physical properties of great interest for future technological applications, including high-temperature superconductivity. The Mott transition at which a material expected to be metallic by band theory becomes insulator. Is probably the most dramatic manifestation of electronic correlations. Mott phenomena have been widely studied in single-orbital systems and play a crucial role in the physics of high temperature cuprate superconductors, which are doped Mott insulators. Contrary to cuprates which can be described with single orbital models, IBS are multiorbital materials. This lead to the emergence of multiple competing interactions that complicates the analysis of correlations. The concept of Hund's metal, for example, has been introduced to emphasize the key role played by the Hund's coupling in realizing a bad metal correlated phase in multiorbital systems. My research focused on two major challenges in the field: on one hand, I pursued a precise characterization of the Hund's metal, including its relation with the Mott physics [1, 2]; on the other, I unveiled the role of Hund's induced correlations in the phenomenology of IBS [3,4], including the emergence of high-temperature superconductivity. The result emerging from my analysis led me to propose a scenario for IBS in which superconductivity emerges from a novel cooperative interplay between strong electronic correlations and the bosonic mode mediating the pairing [4]. My proposal, SuperCoop - Unconventional Superconductivity and Strong Electronic Correlations: a Cooperative mechanism, has been funded by EU within the H2020 MSCA-IF program in 2019.

- (1) L. Fanfarillo and E. Bascones, *Electronic correlations in Hund's metals*, Phys. Rev. B **92**, 075136 (2015)
- (2) A. Isidori, M. Berovic, L. Fanfarillo, L.de'Medici, M. Fabrizio, and M. Capone, *Charge disproportionation, mixed valence, and janus effect in multi-orbital systems: A tale of two insulators*, Phys. Rev. Lett. **122**, 186401 (2019)
- (3) L. Fanfarillo, G. Giovannetti, M. Capone, and E. Bascones, *Nematicity at the Hund's metal crossover in iron superconductors*, Phys. Rev. B **95**, 144511 (2017)
- (4) L. Fanfarillo, A. Valli, and M. Capone, *Synergy between Hund-driven correlations and boson-mediated Superconductivity*, Phys. Rev. Lett. **125**, 177001 (2020)

Trieste, April 29, 2022

Laura Fanfarillo

Luca Lepori

PRESENT ACADEMIC POSITION

Since 01/02/2022: visiting researcher at QSTAR, INO-CNR and LENS, Firenze.
Advisor: prof. Augusto Smerzi.

PAST ACADEMIC POSITIONS

01/02/2020 - 31/01/2022: post-doc researcher at Università della Calabria, Cosenza. *Advisor:* prof. Domenico Giuliano.

15/09/2018 - 15/01/2020: post-doc researcher at Istituto Italiano di Tecnologia, Genova.
Advisor: prof. Marco Polini (Università di Pisa, Istituto Italiano di Tecnologia, and University of Manchester).

01/11/2016 - 31/08/2018 : post-doc researcher at Università dell' Aquila and Laboratori Nazionali del Gran Sasso (from 01/11/2017), L'Aquila, Italy. *Advisors:* prof. Simone Paganelli (Università dell'Aquila), prof. Massimo Mannarelli (Laboratori Nazionali del Gran Sasso).

01/06/2015 - 31/10/2016 : post-doc researcher at Università di Padova, Italy. *Advisors:* prof. Luca Salasnich, prof. Luca Dell'Anna.

01/03/2013 - 31/05/2015 : post-doc researcher at IPCMS-ISIS and Université de Strasbourg, France. *Advisor:* prof. Guido Pupillo.

01/01/2011 - 28/02/2013 : post-doc researcher at Universitat Autònoma de Barcelona, Spain, quantum information group. *Advisor:* prof. Anna Sanpera Trigueroes.

EDUCATION

Università di Pisa, Italy : *bachelor degree in physics*, obtained during the academic year 2003/2004 with a thesis titled: "An introduction to the electromagnetic field quantization".
Supervisor: prof. Enore Guadagnini.
Final mark: 110/110.

Università di Pisa, Italy : *master degree in theoretical physics*, obtained during the academic year 2004/2005 with a thesis titled: "Monopoles and exceptional groups".
Supervisor: prof. Adriano di Giacomo.
Final mark: 110/110 *cum laude*.

SISSA/ISAS, Trieste, Italy: *Ph.D. in statistical physics*.
Admitted via european competition with written and oral exams.
Beginning in October 2006 in the sector of elementary particle physics,
moving to the sector of statistical physics in october 2007.
Advisor: prof. Giuseppe Mussardo (SISSA).
Coadvisor: dr. Andrea Trombettoni (CNR-IOM Democritos and SISSA).
Final discussion on September 27th 2010.
Title of the PhD thesis: "QFT emerging models in condensed matter systems".
No final mark expected.
External referee: prof. German Sierra Rodero (Instituto de fisica teorica UAM-CSIC, Madrid).

MAIN RESEARCH INTERESTS (NOT MEANINGFUL ORDER)

- quantum simulations on cold atoms/condensed matter devices, with application both to condensed matter physics (unconventional superconductivity/superfluidity, topological phases of matter) and to high-energy physics (relativistic systems and QFT models, gauge fields dynamics included).
- methods and ideas from quantum computation applied to condensed matter physics and to quantum simulation on condensed matter devices. Entanglement (entanglement entropy, entanglement spectrum, multipartite entanglement) and its role in the study of phase transitions, unconventional phases of matter, and quantum simulation.
- physics of (multi-)Weyl and Dirac semimetals, topological and anomalous superfluid properties.
- low-dimensional physics, low dimensional field theories, integrable models, with applications to the study of quantum spin chains and generally of condensed matter systems.
- long-range interacting 1D and 2D quantum systems: effects from nonlocality, appearance of new phases, universality classes and topologies, breakdown of conformal symmetry, new entanglement properties.

MAIN ACHIEVED RESULTS (NOT MEANINGFUL ORDER)

For reference, see the next section "Publications and preprints"

- proposals for the realization of high-energy relevant phenomena in ultra-cold fermionic mixtures, including Weyl and Dirac fermions [6], symmetry-locking phases [14],[22], Majorana mass terms for spinors [30].
- simulation of symmetry-protected topological phases by ultra-cold atoms with gauge potentials, including 2D-3D Weyl semimetals [6],[11],[15] and multiple generalizations [18], 2D topological insulators [12].
- proposal of a general approach for the study of axial anomalies [34] and quantum transport [37] in semimetals.
- generalization of the abelian projection technique in QCD to exceptional Lie gauge groups [2]-[3],[5],[7].
- analysis of the scaling and the distribution for the entanglement spectrum close to quantum phase transitions [8],[10], multipartite entanglement [26][35][39].
- proposal of new quantifiers of multipartite entanglement [42].
- co-author of a C-program calculating the spectrum of the Wess-Zumino-Witten theories [9], directly exploiting the representations of the conformal group.
- study of ultra-cold atoms dynamics out of equilibrium: sounds [19], impurities in bosonic condensates [28], effectively unbalanced mixtures [33], many-flavour mixtures [14], [22], long-range coupled bosons [43].
- study of the spectrum induced by static potentials, abelian and nonabelian, on 2D and 3D lattices [25], [27].
- study of (1+1) conformal models with integrable and nonintegrable perturbations [1],[4].
- study of meson condensation, superfluidity, and locking via chiral perturbation theory [23],[36].
- long-range generalizations of the Kitaev chains and relations with the long-range Ising models; discover on them of new types of phases, universality classes, edge states [13],[16-17],[21],[24],[29], transport properties [32].
- study of the consequences of long-rangedness in quantum systems on locality properties, correlation functions, universality classes, CFT breakdown, non equilibrium properties, entanglement content [14],[16-17],[24],[26],[29], transport properties [32], multipartite entanglement [26].
- derivation of the infrared limit of long-range interacting systems [17],[21],[29].

- [1] L. Lepori, G. Mussardo, and G. Z. Toth, “The particle spectrum of the Tricritical Ising Model with spin reversal symmetric perturbations”, J. Stat. Mech. **0809** P09004 (2008).
<http://iopscience.iop.org/article/10.1088/1742-5468/2008/09/P09004>
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*: these authors contributed equally to the present paper.
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- [41] L. Lepori, A. Nava, D. Giuliano, and A. C. Perroni, ”Interplay between singlet and triplet pairings in multi-band oxide superconductors”, *Phys. Rev. B* **104**, 134509 (2021).
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- [45] L. Pezzé and L. Lepori, *Robust multipartite entanglement in dirty topological wires*, arXiv:2204.02209, submitted to Sci. Post.
<https://arxiv.org/abs/2204.02209>

OTHER PROCEEDINGS OF CONFERENCES AND CITED PREPRINTS

- [P1] A. Di Giacomo, L. Lepori, and F. Pucci, *Homotopy, monopoles and 't Hooft tensor for generic $gau(u)$ groups*, arXiv:0808.4041. Not published (become paper [2] of the previous Section) but cited (5 times on arXiv at 13/04/2021).
<https://arxiv.org/abs/0808.4041>
- [P2] A. Di Giacomo, L. Lepori and F. Pucci, *'t Hooft tensor for generic gauge group*, arXiv:0809.4563. Prepared for the 34th International Conference of High Energy Physics 2008, Philadelphia.
<https://arxiv.org/abs/0809.4563>

IN CLOSE SUBMISSION (APPEARANCE EXPECTED AT MOST BY MAY 2022)

- L. Lepori, A. Trombettoni, and A. Smerzi, "Onsager-Penrose criterion and quantum Fisher information in Bose-Einstein condensates".
- L. Lepori, M. Burrello, A. Trombettoni, and S. Paganelli, "Scaling of optimal strange correlators and Onsager-Penrose criterion for topological quantum systems".

BIBLIOMETRIC INDICES

ISI Web of Knowledge (via Publons, to be updated)

- Published papers (since 2008): 40
- Total citations (since 2008): 854
- H-index (since 2008): 16
- average citations per article (since 2008): 21.35

Google Scholar

- Published papers and preprints (since 2008): 45+3
- Total citations (since 2008): 1234 ; (since 2017): 948
- H-index (since 2008): 19 ; (since 2017): 15
- i-10 index (since 2008): 26 ; (since 2017): 21

GIVEN TALKS IN CONFERENCES AND SCHOOLS

- Speaker at the conference "Quantum coherence and correlation in condensed-matter and cold-atoms systems", Evora, Portugal, 11th - 15th October 2010. Short talk: "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices".
- Invited speaker at the workshop "Quantum Information and Quantum Phenomena Pyrenees Meeting 2013" (2nd edition), Espot, Lleida (Spain), 18-20th February 2013. "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Invited speaker at the Spring College of Complex Systems, ICTP, Trieste, 22th May 2013: "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Invited speaker at Winter Workshop on Ultracold Quantum Matter, Padova, 11th January 2016: "Ultra-cold atoms as universal quantum simulators: symmetry-locked superfluid phases".
- Invited speaker at "From Static to Dynamical Gauge Fields with Ultracold Atoms", Galileo Galilei Institute for Theoretical Physics, Firenze, 22th May - 23th June 2017: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Speaker at the conference "FisMat 2017", ICTP-SISSA Miramare Campus, Trieste, October 1-5th 2017: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Invited speaker at the conference "Quantum Path", Erwin Schrödinger International Institute for Mathematics and Physics, Wien, May 30th 2018: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Speaker at the 105th conference of the Società Italiana di Fisica, Gran Sasso Science Institute, L'Aquila, September 23-27th 2019: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Speaker at the conference "Quantum gases, fundamental interactions and cosmology-Second Edition (QFC 2019)", Pisa, October 23-25th 2019: "Synthesis of Majorana mass terms in low-energy quantum systems".
- Speaker at the conference "SM and FT 2019 - The XVIII Workshop on Statistical Mechanics and nonperturbative Field Theory", Bari, December 11-13th 2019: "Abelian axial anomalies in 3D semimetals".

- Invited speaker to the "Online Workshop on Quantum Information Science", Teheran 1th - 2nd February 2022, School of Nano Science, Institute for Research in Fundamental Sciences (IPM), Tehran, Iran: "Characterizing multipartite entanglement through correlation functions".

GIVEN SEMINARS IN UNIVERSITIES AND RESEARCH CENTERS

- Speaker at SISSA, March 2009: "Colour confinement: ideas and methods from statistical physics", based on my research in collaboration with the lattice gauge group of Università di Pisa.
- Invited speaker at LAPTH Annecy (France), 8th April 2010: "Simulation of (3+1) Dirac fermions by ultracold atoms in optical lattices".
- Speaker at joint ICTP-SISSA Statistical Physics seminar, Trieste, May 25th 2010: "Simulation of massive (3+1) Dirac fermions by ultracold atoms in optical lattices".
- Invited speaker at Max-Planck Institut für Quantenoptik, Garching (Germany), 27th July 2010: "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices".
- Invited speaker at Università della Calabria, Cosenza (Italy), 18th November 2010: "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices".
- Invited speaker at Universidad Complutense de Madrid, 25th November 2010: "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices".
- Speaker at Universitat Autònoma de Barcelona, 5th May 2011: "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices".
- Invited speaker at Universitat de Barcelona, 3rd July 2012: "New fun with QFT by ultra-cold atoms on optical lattices".
- Speaker at Universitat Autònoma de Barcelona, 24th July 2012: "New fun with QFT by ultra-cold atoms on optical lattices".
- Invited speaker at Instituto de Física Teórica UAM/CSIC, Universidad Autònoma de Madrid, 22-th October 2012: "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Invited speaker at Institute for Quantum Optics and Quantum Information, Innsbruck, 8th November 2012: "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Invited speaker at Lens, Firenze, 27th June - 28th June 2013: "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Invited speaker at Università di Trento-BEC, Trento, 19th February 2014: "Long-range interacting Kitaev chains".
- Invited speaker at INRIM, Torino, 30th September 2014: "Long-range interacting Kitaev chains".

- Invited speaker at Scuola Normale Superiore, Pisa, 24th October 2014: "Long-range interacting Kitaev chains".
- Invited speaker at Gran Sasso Laboratories, L'Aquila, Italy, 17th February 2015: "Ultra-cold atoms as universal quantum simulators: symmetry-locked superfluid phases".
- Invited speaker at Università della Calabria, Cosenza (Italy), 9th June 2015: "Long-range interacting Kitaev chains".
- Invited speaker at Università della Calabria, Cosenza (Italy), 11th June 2015: "Ultra-cold atoms as universal quantum simulators: symmetry-locked superfluid phases".
- Speaker at Università di Padova, 4th November 2015: "Two key examples of long-range quantum chains".
- Invited speaker at Gran Sasso Laboratories, L'Aquila, Italy, 18th December 2015: "Unexpected effects in long-range quantum models".
- Invited speaker at Politecnico Torino, Dipartimento di Scienza Applicata e Tecnologia, 17th March 2016: "Unexpected effects in long-range quantum models".
- Invited speaker at Università di Pisa, Dipartimento di Fisica, 5th May 2016: "Unexpected effects in long-range quantum models".
- Invited speaker at Università della Calabria, Cosenza (Italy), 30th June 2016: "Multi-Weyl semi-metals in synthetic gauge potentials".
- Invited speaker at Università dell'Aquila, L'Aquila (Italy), 7th December 2016: "An introduction to ultra-cold atoms". Tutorial, also for master and PhD students.
- Invited speaker at Università di Camerino, Camerino (Italy), 28th September 2017: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Speaker at Università dell'Aquila, L'Aquila (Italy), 9th October 2017: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Invited speaker at Universidad Complutense de Madrid, 10th July 2018: "Emergence of elementary particle phenomena on semimetals".
- Invited speaker at Università della Calabria, Cosenza (Italy), 11th September 2018: "Dirac and (multi-)Weyl semimetals: condensed matter physics meets particle physics".
- Invited speaker at Università dell'Aquila, L'Aquila (Italy), 10th October 2018: "Dirac and (multi-)Weyl semimetals: condensed matter physics meets particle physics".
- Speaker (internal) at Scuola Normale Superiore, Pisa, 7th November 2018: "Emergent Majorana mass terms in condensed matter devices".
- Invited speaker at Università di Napoli, 12th December 2018: "Dirac and (multi-)Weyl semimetals: condensed matter physics meets particle physics".
- Invited speaker at Università della Calabria, Cosenza (Italy), 10th July 2019: "Emergent axion quasiparticles in condensed matter systems".

- Invited speaker at Università dell'Aquila, L'Aquila (Italy), 11th September 2019: "Emergent axion quasiparticles in condensed matter systems".
- Speaker (internal) at Scuola Normale Superiore, Pisa, 27th November 2019: "Abelian axial anomalies in multi-Weyl and triple-point semimetals".
- Invited speaker at Ecole Normale Supérieure de Lyon, 30th January 2020: "Abelian axial anomalies in multi-Weyl and triple-point semimetals".
- Invited online speaker to International Institute of Physics, Natal (Brasil), 10th September 2020: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Invited online speaker to Heinrich-Heine-Universität, Düsseldorf (Germany), 10th June 2021: "Abelian axial anomalies in multi-Weyl and triple-point semimetals".
- Invited speaker to Niels Bohr Institute, Copenhagen, 15th December 2021: "Characterizing multipartite entanglement through correlation functions".
- Speaker at the online meeting "TOP-SPIN Project Meeting", 1th February 2022: "Interplay between singlet and triplet pairings in multi-band oxide superconductors".

POSTER PRESENTATIONS IN CONFERENCES AND SCHOOLS

- "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices", poster session at "New frontiers in graphene physics" conference, ECT* European Center for Theoretical Studies in Nuclear Physics and Related Areas, Trento, 12-14th April 2010.
- "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices", poster session at "Quantum coherence and correlation in condensed-matter and cold-atoms systems", Evora, Portugal, 11th-15th October 2010.
- "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices", poster session at "Quantum coherence and correlation in condensed-matter and cold-atoms systems", Workshop "Quantum Simulation", Benasque, Spain, 28th February - 5th March 2011.
- "Scaling of the entanglement spectrum in the vicinity of the Haldane phase", poster session at the workshop "Quantum Optical Information Technology", Barcelona 5-7th October 2011.
- "Scaling of the entanglement spectrum in the vicinity of a critical point", poster session at the workshop "Topological states of matter", Freiburg 18-22th March 2012.
- "Fractional Vortices with Non-Abelian Modes in Ultracold Color-flavor Locked Phases", poster session at the workshop "Ultracold Atoms and Gauge Theories", International Center for Theoretical Physics, Trieste, 13-17th May 2013.
- "Long-range interacting Kitaev chains", poster session at the conferences "Progresses in quantum information and quantum simulation", Lyon, 17-19th November 2014.

- "Dynamics of Rabi-coupled and interacting two-components Fermi gas", poster session at the workshop "Frontiers in ultracold Fermi gases - 90 years after the "birth" of fermions in Florence", Galileo Galilei Institute, Firenze, 21-23th March 2016.

DIDACTIC ACTIVITY

- Tutor for Master Thesis: A. Maraga, "Study of Rabi and Josephson coupled ultracold Fermi systems", Università di Trento and SISSA/ISAS (Trieste), academic year 2011/2012. Advisor: Prof. Andrea Trombettoni, CNR-IOM Democritos and SISSA, Trieste.
- Tutor for Master Thesis: G. Mazzucchi, "BCS-BEC crossover on layered Fermi-Hubbard model with Dirac points", Università di Trento and SISSA/ISAS (Trieste), academic year 2011/2012. Advisor: Prof. Andrea Trombettoni, CNR-IOM Democritos and SISSA, Trieste.
- Tutor for Ph.D. thesis: D. Vodola, "Correlations and Quantum Dynamics of 1D Fermionic Models: New Results for the Kitaev Chain with Long-Range Pairing", Università di Bologna and ISIS-IPCMS, Université de Strasbourg, academic years 2012/2015. Advisors: Prof. Elisa Ercolessi (Univ. Bologna) and Prof. Guido Pupillo (Univ. Strasbourg).
- Tutor for Ph.D. thesis: Joao Pinto Barros, "Field and Gauge Theories with Ultracold Atoms", SISSA (Trieste), academic years 2013/2017. Advisors: Prof. Andrea Trombettoni (CNR-IOM Democritos and SISSA), and Doc. Marcello Dalmonte (ICTP and SISSA, Trieste).
- Tutorial, also for master and PhD students, at Universitat Autònoma de Barcelona, Spain, July 2012: "Fun with ultracold atoms: an introduction to the quantum simulation of high-energy physics".
- Invited speaker at the Spring College of Complex Systems, ICTP, Trieste, 22th May 2013: "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Tutorial, also for master and PhD students, at Università dell'Aquila, L'Aquila (Italy), 7th December 2016: "An introduction to ultra-cold atoms".
- Tutorial, also for master and PhD students, at QSTAR, Firenze, March 2017: "Symmetry-protected topological matter".
- Trainer for Physics Olympiad, Italian national selection 2018, of the team from Abruzzo (Italian region).
- Course "Quantum mechanics 2", Università della Calabria, academic year 2020/2021. Teaching assistant.
- Co-relator for bachelor degree of the student Mattia Rudi. Title of the thesis: "Axion dynamics at the surfaces of strong topological insulators". First relator: prof. Domenico Giuliano. Università della Calabria, academic year 2020/2021.

- Teaching assistant and examiner for the course "General physics with elements of mathematics", concerning the bachelor degrees in "pharmacy" (first semester) and in "chemical and pharmaceutical technologies" (second semester), Università di Pisa, academic year 2020/2021.
- Course "Quantum Field Theory A", for the 4th year of the master degree in (theoretical) physics, Università della Calabria, academic year 2020/2021. Teaching assistant and examiner.
- Teaching assistant and examiner for the course "General physics with elements of mathematics", concerning the bachelor degrees in "pharmacy" (first semester) and in "chemical and pharmaceutical technologies" (second semester), Università di Pisa, academic year 2021/2022.

PARTICIPATION TO RESEARCH PROJECTS

- PROJECT TITLE: INSTANS
FINANCIAL ENTITY: EUROPEAN SCIENCE FOUNDATION
DURATION: FROM: OCTOBER 2005, TO: OCTOBER 2010.
PRINCIPAL INVESTIGATOR: Giuseppe Mussardo (SISSA, Trieste).
DESCRIPTION: on the webpage <https://people.sissa.it/~mussardo/>
- PROJECT TITLE: PI12.
FINANCIAL ENTITY: INFN, Italy.
DURATION: FROM: 2006, TO: 2010, included.
PRINCIPAL INVESTIGATOR: Adriano Di Giacomo (univ. Pisa and INFN).
DESCRIPTION (taken from the web): Confinement of color and deconfining transition in QCD. Focus on the effective mechanism of "dual superconductivity" of the QCD vacuum.
- PROJECT TITLE: MINECO (FIS2008- 01236)
FINANCIAL ENTITY: European Regional development Fund.
DESCRIPTION: Generalitat de Catalunya Grant No. SGR2009-00347.
- PROJECT TITLE: 2012 ERC Starting Grant
FINANCIAL ENTITY: EUROPEAN SCIENCE FOUNDATION.
DURATION: FROM: 2013, TO: 2018, included.
PRINCIPAL INVESTIGATOR: Guido Pupillo (ISIS and IPCMS, Strasbourg), winner of the grant.
- PROJECT TITLE: NEUMATT
FINANCIAL ENTITY: INFN, Italy.
LENGHT: still running.
PRINCIPAL INVESTIGATOR: Alessandro Drago (univ. Ferrara).
DESCRIPTION: at the webpage
<https://web.infn.it/CSN4/IS/Linea5/NEUMATT/NEUMATT.html>.
- PROJECT TITLE: GRAPHENE FLAGSHIP
FINANCIAL ENTITY: EUROPEAN SCIENCE FOUNDATION.
DESCRIPTION: at the webpage <https://graphene-flagship.eu/>.

- PROJECT TITLE: PRIN project 2017 number 20177SL7HC
 FINANCIAL ENTITY: Italian ministry of education and research, Italy.
 DURATION: FROM: 2019, TO: 2022, included.
 PRINCIPAL INVESTIGATOR: Marco Salluzzo (CNR, Napoli).
 DESCRIPTION: at the webpage <https://www.spin.cnr.it/images/TOPSPIN.pdf>

COLLABORATION WITH SPECIALIZED REVIEWS

Referee for Physical Review A/B/D/E, Physical Review Letters, Journal of Condensed Matter, Journal of Physics A, Scientific Reports, International Journal of Modern Physics, and Nature Communications.

COMPUTER SKILLS

Good knowledge of FORTRAN, C, C++, Python, MATLAB, Mathematica, Kwant packages for simulations of transport in nanostructures.

SPOKEN LANGUAGES

- Italian, mother tongue.
- English, fluent.
- French, basic level.
- Spanish, basic level.

PUBLIC OUTREACH

- Organizer of the "Notte dei Ricercatori", Trieste, September 24th 2010, in the group "Ricercatori Erranti".
 Co-author of the public document "Il futuro della ricerca" (The future of research).
- Trainer for Physics Olympiad, Italian national selection 2018, of the team from Abruzzo (Italian region).

FUNDING AND HONOURS

- January 2011: fellowship (3-6 years) of the FCT Fundacao Para a Ciencia e a Tecnologia, Ministerio da Ciencia, Tecnologia e Ensino Superior, Portugal. Amount of the grant per year: 19.000 euro (nets). *Renounced.*
- November 2012: fellowship from the Angelo Della Riccia foundation, Florence (Italy). Fellowship for Italian young researchers willing to make investigation in a foreign country. Elected research center: Universitat Autònoma de Barcelona, Group of Quantum Information and Quantum Phenomena, Barcelona, Spain. Total amount of the grant: 13.500 euro. *Renounced.*

- February 2019: co-writer and external recipient of the PRIN project 2017 number 20177SL7HC, financed by the Italian Ministry of education and research.
- Title "Expert in Physics" (eligibility as examiner for academic courses in physics), Università di Pisa, Department of Pharmacy, academic years 2020/2021 and 2021/2022.

ITALIAN MINISTERIAL LICENSES

- Italian ministerial eligibility for associate professor of condensed matter theory (FIS-02/B2), from 03/04/2018 to 03/04/2027.
- Italian ministerial eligibility for associate professor of theory of fundamental interactions (FIS-02/A2), from 13/07/2018 to 13/07/2027.
- Italian ministerial eligibility for full professor of condensed matter theory (FIS-02/B2), from 27/01/2022 to 27/01/2031.

FRENCH MINISTERIAL LICENSES

- French ministerial eligibility for "maitre de conférence" (comparable to associate professor) of condensed matter theory (28 - milieux denses et matériaux), from 26/02/2020.

ACADEMIC REFERENCES (ALPHABETICAL ORDER)

Maria Luisa Chiofalo

Associate professor
 Department of Physics "E. Fermi", Università di Pisa
 Largo B. Pontecorvo 3, 56127, Pisa, Italy
 tel. +39 050 509111
 e-mail: maria.luisa.chiofalo@unipi.it

Luca Dell'Anna

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 Department of Physics "G. Galilei", Università di Padova
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 email: luca.dellanna@pd.infn.it

Gesualdo Delfino

Associate professor
 SISSA/ISAS
 Via Bonomea 265, 34151 Trieste, Italy
 tel. +39 040 3787427
 e-mail: delfino@sissa.it

Adriano Di Giacomo

Emeritus professor of theoretical physics
Department of Physics “E. Fermi”, Università di Pisa
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tel. +39 050 2214502
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Domenico Giuliano

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Department of Physics, Università della Calabria
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tel. +39 0984 496029
e-mail: domenico.giuliano@fis.unical.it

Alexey V. Gorshkov

Fellow
Joint Quantum Institute and Joint Center for Quantum Information and Computer Science,
NIST/University of Maryland,
2207 CSS Bldg, College Park, Maryland 20742, USA
tel. +1 (301) 405-8934
e-mail: gorshkov@umd.edu

Enore Guadagnini

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tel. +39 050 2214502
e-mail: enore.guadagnini@df.unipi.it

Miguel-Angel Martin-Delgado

Full professor
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Facultad de Ciencias Físicas
Universidad Complutense de Madrid
Avenida Complutense s/n, 28040 Madrid
tel. +34 91394-4526
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Massimo Mannarelli

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e-mail: massimo@lngs.infn.it

Giuseppe Mussardo

Full professor of theoretical physics
SISSA/ISAS
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tel. +39 040 3787411
e-mail: mussardo@sissa.it

Simone Paganelli

Associate professor
Department of Physics and Chemistry, Università dell'Aquila
via Vetoio, I-67010 Coppito-L'Aquila, Italy.
tel. +39 0862433059
e-mail: simone.paganelli@univaq.it

Anna Sanpera Trigueroes

ICREA full professor of physics
Depart. Theoretical Physics
Universitat Autònoma de Barcelona
08193 Bellaterra, Spain
phone: + 34 935 812 843
e-mail: sanpera@ifae.es

German Sierra Rodero

Full professor of research
Instituto de Física Teórica UAM-CISC
C. Nicolas Cabrera 13-15
Universidad Autónoma de Madrid
Cantoblanco, 28049 Madrid, Spain.
phone: +34 91 299 9875
e-mail: german.sierra@uam.es

Augusto Smerzi

Research Director
INO-CNR, QSTAR, and LENS
Largo Enrico Fermi 2
50125 Firenze, Italy.
phone: +390552755095
e-mail: augusto.smerzi@ino.it

Andrea Trombettoni

Tenured professor,
Department of Physics, University of Trieste,
Strada Costiera 11, I-34151 Trieste, Italy
CNR-IOM Democritos and SISSA, Trieste
Via Bonomea 265, 34151 Trieste, Italy
tel. +39 040 2240 260
e-mail: atrombettoni@units.it; andreatr@sissa.it

Curriculum Vitae

Current Position

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|----------------------|--|
| 1/6/2021- Present | Carl Trygger Fellow- Stockholm University, Stockholm |
|----------------------|--|

Previous Positions

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|-------------------------|---|
| 1/6/2019- 31/5/2021 | Postdoctoral Fellowship- KTH Royal Institute of Technology, Stockholm |
| 26/2/2018- 31/5/2019 | Postdoctoral Fellowship- Sapienza University of Rome, Roma |
| 1/9/2013- 31/10/2014 | Research assistant- Saarland University, Saarbrücken |

Education

| | |
|--------------------------|---|
| 1/11/2014- 26/2/2018 | PhD- Sapienza University of Rome, Roma <u>PhD Thesis</u> - "Berezinskii-Kosterlitz-Thouless transition in disordered superconducting films" <u>Supervisors:</u> C. Castellani and L. Benfatto <u>Commissione:</u> Prof. Andrea Crisanti, Prof. Antonio Garcia-Garcia, and Prof. Thierry Giamarchi <u>Date of PhD defence:</u> 26/02/2018 |
| 1/09/2010- 29/01/2013 | MSc with honors - Sapienza University of Rome, Roma <u>MSc Thesis</u> - "Statistical Mechanics of Superconducting Islands in 2D" <u>Final Grade:</u> 110/110 cum laude <u>Supervisor:</u> Prof. Enzo Marinari |
| 1/09/2007- 5/11/2010 | BSc with honors- Sapienza University of Rome, Roma <u>BSc Thesis</u> - "Boltzmann's contribution to the problem of irreversibility" <u>Final Grade:</u> 110/110 cum laude <u>Supervisor:</u> Prof. Sergio Caprara |
| 9/09/2002- 20/07/2007 | High School Diploma- Liceo Scientifico "I. Newton", Roma <u>Final Grade:</u> 100/100 |

Fellowships and awards

- Percorsi di eccellenza
2010-Awarded of the merit-based fellowship Percorsi di eccellenza.

Publications

1. *Uniformly frustrated XY model: strengthening of the vortex lattice by intrinsic disorder*
I. Maccari, L. Benfatto and C. Castellani
Condensed Matter 6 (4), 42 (2021)
2. *State with spontaneously broken time-reversal symmetry above the superconducting phase transition*
V. Grinenko, D. Weston, F. Caglieris, C. Wuttke, C. Hess, T. Gottschall, I. Maccari, D. Gorbunov, S. Zherlitsyn, J. Wosnitza, A. Rydh, K. Kihou, Chul-Ho Lee, R. Sarkar, S. Dengre, J. Garaud, A. Charnukha, R. Hühne, K. Nielsch, B. Büchner, Hans-Henning Klauss, and E. Babaev
Nature Physics 17, 1254–1259 (2021)
3. *Finite-Frequency Dissipation in Two-Dimensional Superconductors with Disorder at the Nanoscale*
G. Venditti, I. Maccari, M. Grilli and S. Caprara
Nanomaterials 11 (8), 1888 (2021)
4. *Interplay of spin waves and vortices in the two-dimensional XY model at small vortex-core energy*
I. Maccari, N. Defenu, L. Benfatto, C. Castellani, and T. Enss
Phys. Rev. B 102 (10), 104505 (2020)
5. *Superfluid Properties of Superconductors with Disorder at the Nanoscale: A Random Impedance Model*
G. Venditti, I. Maccari, M. Grilli, S. Caprara
Condensed Matter 5 (2), 36 (2020)
6. *Melting of the vortex lattice through intermediate hexatic fluid in a-MoGe thin film*
I. Roy, S. Dutta, A. N. R. Choudhury, S. Basistha, I. Maccari, S. Mandal, J. Jesudasan, V. Bagwe, C. Castellani, L. Benfatto, P. Raychaudhuri
Phys. Rev. Lett. 122 (4), 047001 (2019)
7. *Kane-Fisher weak link physics in the clean scratched-XY model*
G. Lemarié, I. Maccari, C. Castellani
Phys. Rev. B 99 (5), 054519 (2019)
8. *Disordered XY model: effective medium theory and beyond*
I. Maccari, L. Benfatto, C. Castellani
Phys. Rev. B 99 (10), 104509 (2019)
9. *The BKT Universality Class in the Presence of Correlated Disorder*
I. Maccari, L. Benfatto, C. Castellani
Condensed Matter 3 (1), 8 (2018)
10. *Broadening of the Berezinskii-Kosterlitz-Thouless transition by correlated disorder*
I. Maccari, L. Benfatto, C. Castellani
Phys. Rev. B 96 (6), 060508 (2017)
11. *Cytoskeleton rotation relocates mitochondria to the immunological synapse and increases calcium signals*
I. Maccari, R. Zhao, M. Peglow, K. Schwarz, I. Hornak, M. Pasche, A. Quintana, M. Hoth, B. Qu, H. Rieger
Cell calcium 60 (5), 309-321 (2016)
12. *A numerical study of planar arrays of correlated spin islands*
I. Maccari, A. Maiorano, E. Marinari, J.J. Ruiz-Lorenzo
The European Physical Journal B 89 (5), 127 (2016)

Preprints

1. *Effects of intercomponent couplings on the appearance of time-reversal-symmetry-breaking fermion-quadrupling states in two-component London models*

I. Maccari and E. Babaev
arXiv preprint arXiv:2112.14635

2. *Transport signatures of fragile-glass dynamics in the melting of the two-dimensional vortex lattice*
I. Maccari, Bal K Pokharel, J. Terzic, Surajit Dutta, J. Jesudasan, Pratap Raychaudhuri, J. Lorenzana, C. De Michele, C. Castellani, L. Benfatto and Dragana Popović
arXiv preprint arXiv:2202.02269

In preparation

1. *Possible time-reversal-symmetry-breaking fermionic quadrupling condensate in twisted bilayer graphene*
I. Maccari, J. Carlström, and E. Babaev
2. *Fragile-to-strong glass transition in two-dimensional vortex lattice*
I. Maccari, J. Lorenzana, C. De Michele, C. Castellani, and L. Benfatto

Conference Presentations

| | |
|---------------------------|---|
| 28/06/2021 - 2/07/2021 | "Superconducting Hybrids @ Extreme" - hybrid online in-person meeting, Štrbské Pleso, Slovakia <u>Talk title:</u> "Fragile glass transition in thin superconducting films". |
| 14-16/06/2021 | "SuperFluctuations 2021" - Online Conference <u>Talk title:</u> "Fragile glass transition in two-dimensional vortex lattice". |
| 29/10/2019 | Condensed Matter Seminar - jointly organized by KTH, SU and Nordita, Stockholm, Sweden <u>Talk title:</u> "Vortex physics in 2D disordered superconductors". |
| 4/9/2019- 6/9/2019 | "SuperTop2019" International Workshop, Sapienza University of Rome, Italy <u>Talk title:</u> "Vortex physics in 2D disordered superconductors". |
| 16/04/2019 | Ruprecht-Karls-Universität , Heidelberg, Germany <u>Seminar Presentation:</u> "Vortex physics in 2D disordered superconductors" |
| 7/10/2018- 12/10/2018 | "School on quantum materials and workshop on vortex behaviour in unconventional superconductors" , Braga, Portugal <u>Talk title:</u> "Vortex physics in 2D disordered superconductors". |
| 24/9/2018- 26/9/2018 | "Young Women in Mathematical Physics" International Workshop, University Bonn, Bonn, Germany <u>Talk title:</u> "Vortex physics in 2D disordered superconductors" |
| 6/09/2018 | KTH Royal Institute of Technology , Stockholm, Sweden <u>Seminar Presentation:</u> "Vortex physics in 2D disordered superconductors" |
| 18/04/2018 | Ruhr-Universität , Bochum, Germany <u>Seminar Presentation:</u> "BKT transition in disordered superconducting films" |
| 1/10/2017- 6/10/2017 | "FISMAT2017" : the Italian National Conference on the Physics of Matter, ICTP, Trieste, Italy <u>Talk title:</u> "BKT transition in disordered superconducting films". |
| 19/09/2017 | Tata Institute of Fundamental Research , Mumbai, India <u>Seminar Presentation:</u> "BKT transition in disordered superconducting films". |
| 26/04/2017 | Technische Universität Wien , Wien, Austria <u>ViCoM Seminar Presentation:</u> "BKT transition in disordered superconducting films". |
| 19/9/2016- 21/9/2016 | "SuperFOX2016" : Third Conference on Superconductivity and Functional Oxides, Politecnico of Turin, Turin, Italy <u>Talk title:</u> "BKT transition in disordered superconducting films". |

Visiting International Research Institutes

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|---------------------------|--|
| 15/04/2019- 18/04/2019 | Ruprecht-Karls-Universität, Heidelberg |
| 6/09/2018- 7/09/2018 | KTH Royal Institute of Technology, Stockholm, |
| 17/04/2018- 19/04/2018 | Ruhr-Universität, Bochum |
| 14/09/2017- 25/09/2017 | Tata Institute of Fundamental Research, Mumbai |
| 24/04/2017- 26/04/2017 | Technische Univesität Wien, Wien |

Other Conference Partecipations

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|--------------------------|---|
| 25/05/2021- 4/06/2021 | "Vortex 2021" 18th International Online Vortex Workshop <u>Poster contribution:</u> "Interplay of spin waves and vortices in the twodimensional XY model at small vortex-core energy" |
| 6/09/2017- 8/09/2017 | "SuperFluctuations 2017" International Workshop, University of Camerino, Camerino <u>Poster contribution:</u> "Broadening of the BKT transition in the presence of correlated disorder" |
| 7/08/2017- 19/08/2017 | "SUNSET2017" - School on Unconventional Superconductivity: Theory and Experiment, IESC, Cargese <u>Poster contribution:</u> "Broadening of the BKT transition in the presence of correlated disorder" |
| 3/10/2016- 7/10/2016 | "Tocotronics2016": Fall School and Workshop "Correlated electrons at surfaces and interfaces", Würzburg University, Würzburg <u>Poster contribution:</u> "Broadening of the BKT transition in the presence of correlated disorder" |
| 10/8/2015- 21/8/2015 | School and Workshop on Strongly Correlated Electronic Systems - Novel Materials and Novel Theories, ICTP, Trieste <u>Poster contribution:</u> "Numerical simulations of planar arrays of correlated spin islands". |
| 23/9/2014- 26/9/2014 | Cell Physics - SFB Workshop, Saarland University, Saarbrücken <u>Poster contribution:</u> "Interplay of channels, pumps and organelle location in calcium micro-domain formation". |

Research Projects

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|------------|--|
| 2022-2023: | SNIC 2021/6-355 and SNIC 2021/3-2 <u>Title:</u> "Novel computational approaches for superconducting materials and modelling of superconducting qubits". <u>Principal Investigator:</u> Prof. Egor Babaev, KTH, Stockholm, Sweden. <u>Type of participation:</u> Proxy for the PI |
| 2017-2019: | Maeci- SuperTop <u>Title:</u> "Topological Phases of Matter in 2D Superconducting materials". <u>Entity:</u> Ministry of Foreign Affairs and International Cooperation- Significant Research project within the frame of the Executive Programme of Scientific and Technological Cooperation between Italy and India. <u>Principal Investigators:</u> Prof. Lara Benfatto, Sapienza University, Rome, Italy and Prof. Pratap Raychaudhuri, TIFR, Mumbai, India. <u>Amount granted:</u> 70,000 euros <u>Type of participation:</u> Researcher |

Teaching experiences

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|--------------------------|--|
| 24/11/2021 | Tutoring on Quantum Computing - Guest lecture at Vetenskapens Hus, Stockholm |
| 1/02/2018- 28/02/2018 | Substitute Teaching for Physics - "G.C. Argan" High School, Rome <u>Description:</u> Teaching Physics to a 4th-year High-School class. |
| 1/10/2017- 20/12/2017 | OFA course in Mathematics (Analysis) -Sapienza University of Rome, Rome Winner of a fellowship for academic teaching and tutoring. <u>Description:</u> Teaching of mathematical analysis to first-year students in the Faculty of Science. |
| 1/10/2016- 20/12/2016 | OFA course in Mathematics (Analysis) -Sapienza University of Rome, Rome Winner of a fellowship for academic teaching and tutoring. <u>Description:</u> Teaching of mathematical analysis to first-year students in the Faculty of Science. |
| 1/10/2015- 20/12/2015 | OFA course in Mathematics (Analysis)-Sapienza University of Rome, Rome Winner of a fellowship for academic teaching and tutoring. <u>Description:</u> Teaching of mathematical analysis to first-year students in the Faculty of Science. |

Scientific Responsibilities

Referral activities:

Referee for APS (Physical Review Letters, Physical Review B), Nature Materials and Nature Scientific Reports.

Scientific outreach activities

Articles

| | |
|------------|--|
| 15/10/2021 | "La forza della semplicità"- I. Maccari Article on a weekly italian magazine "Left". |
| 6/11/2020 | "La teoria svedese sull'amore, al tempo della pandemia"- I. Maccari Article on a weekly italian magazine "Left". |
| 9/02/2020 | "Le streghe, l'immaginazione e la scienza" - I. Maccari, G. Venditti and A. Nota Article on a weekly italian magazine "Left". |
| 20/07/2020 | "Se volere la Luna è poter fare ricerca scientifica" - I. Maccari, G. Venditti and A. Nota Article on a weekly italian magazine "Left". |
| 14/04/2019 | "Invenzione e scoperta, le gambe della scienza" - I. Maccari, G. Venditti and A. Nota Article on a weekly italian magazine "Left". |
| 23/03/2019 | "Una nuova società della conoscenza" - I. Maccari, G. Venditti and A. Nota Article on a weekly italian magazine "Left". |

Talks

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| 12/03/2022 | Presentation of the book by Elisabetta Amalfitano: "Controstoria della ragione- Il grande inganno del pensiero occidentale"- Auditorium Parco della Musica, Rome. |
| 11/04/2020 | "Women in Science" event - "European Library", Rome. |
| 12/01/2019 | Giornate di studio 2018/2019: "Rivoluzione del pensiero - Fisica: Isaac Newton" - Via Roma Libera 23, Rome. |
| 6/11/2015 | "Materia, energia, pensiero: fisica e teoria della nascita" - Aula Magna, "La Sapienza" University, Rome. |

Book chapters

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|---|
| G.Venditti, A. Nota and I. Maccari, " <i>Colored Computers</i> : breve storia delle donne che permisero all'uomo di esplorare lo spazio.", in Quando la donna sa inventare il mondo. Left (editorialeNovanta) (2021). ISBN: 978-88-94977-46-2 |
| I. Maccari, Materia, in Atti Convegni all'Aula Magna Università di Roma. L'Asino d'oro edizioni (2016). ISBN: 978-88-6443-372-1 |

Scientific events

| | |
|---------------------------|--|
| 19/03/2009- 22/03/2009 | Assistant and Animator at "Italian Math Festival" -Auditorium Parco della Musica of Rome, Rome Description: Explanation and discussion of physical experiments and math curiosities with a broad audience of non-experts. |
| 15/01/2007- 21/01/2007 | Assistant at "Italian Science Festival" -Auditorium Parco della Musica of Rome, Rome Description: Presentation and discussion of a physical experiment with a broad audience of non-experts. |

Languages

| | |
|---------|-----------------|
| Italian | Native language |
| English | Fluent |
| French | Fluent |

Programming Languages

C; C++; Python; Bash; Gnuplot; Mathematica.

Matteo Rosati

Sommario

La mia attività di ricerca è centrata sullo sviluppo di modelli matematici di **manipolazione dell'informazione in sistemi quantistici**, specificamente ai fini di **comunicazione e metrologia**, e della loro **implementazione fisica con tecnologie quantistiche attuali**, in particolare nel campo dell'**ottica quantistica**.

Ho conseguito la laurea in Fisica presso l'Università La Sapienza di Roma con il Prof. **G. Parisi**, Premio Nobel per la Fisica 2021. Ho svolto il dottorato di ricerca presso la **Scuola Normale Superiore di Pisa**, ottenendo una borsa di perfezionamento sotto la supervisione del Prof. **V. Giovannetti**, esperto di comunicazione e metrologia ottica quantistica a livello mondiale. Durante questo periodo, ho avviato la mia principale linea di ricerca nella comunicazione e metrologia quantistica (CMQ), conseguendo **7 pubblicazioni come primo autore, inclusa 1 in Nat. Comm.**, nelle seguenti tematiche: (i) elaborazione di algoritmi di **scrittura ed estrazione dell'informazione in sistemi quantistici**; (ii) modellizzazione e ottimizzazione di **apparati quantistici in sistemi bosonici** (sistemi quantistici infinito-dimensionali); (iii) determinazione dei **limiti fondamentali** nella trasmissione ed estrazione dell'informazione in sistemi quantistici (teoria di Shannon quantistica).

Durante il post-doc nel Gruppo d'Informazione Quantistica presso l'Università Autonoma di Barcellona (UAB), supportato da fondi competitivi nazionali spagnoli, ho collaborato con il Prof. **A. Winter**, punto di riferimento mondiale per l'informatica quantistica, e il Prof. J. Calsamiglia, esperto in inferenza statistica quantistica. In questo frangente, la realizzabilità delle proposte teoriche di CMQ con apparati realistici, mi ha spinto allo studio di: (i) **teorie delle risorse quantistiche**, che quantificano le capacità di manipolazione dell'informazione quantistica in presenza di restrizioni operazionali; (ii) **inferenza statistica quantistica** (test d'ipotesi con stati e canali quantistici, teoria della stima quantistica).

Nel 2019 ho ottenuto una borsa **Marie Skłodowska Curie** dall'UE (iniziata nel 2020), con un progetto che sintetizza la mia esperienza nel campo della comunicazione ottica, occupandomi di **applicare metodi d'intelligenza artificiale all'ottimizzazione di apparati di comunicazione e rilevazione quantistica**.

Durante questo periodo ho conseguito **9 pubblicazioni (+1 preprint), inclusa 1 in Phys. Rev. Lett, 2 in Quantum, 1 in Phys. Rev. Res e 4 in IEEE Proceedings**, eseguendo ricerca in prima persona e co-supervisionando **2 studenti di dottorato e 3 di laurea triennale**, con un team internazionale di collaboratori da Barcellona, Monaco, Pisa, Ulm, Sidney, Dresda, Milano.

I miei risultati sono stati **presentati in più di 20 talks e 12 poster** in conferenze e gruppi di ricerca internazionali (incluse TQC, IEEE ISIT, CEWQO). Ho realizzato 4 brevi visite di ricerca in gruppi di riferimento per l'informazione quantistica internazionale, inclusa **l'Università di Hong Kong** e 1 visita di un mese presso la **Technische Universität di Monaco**. A partire dal 2019 ho inoltre ottenuto **finanziamenti** personali da prestigiosi enti, quali la **Commissione Europea** e l'**Agenzia Spaziale Europea**, per un totale di circa **730k€**.

Sono attivo come **referee** per giornali scientifici di prestigio in fisica e teoria dell'informazione, inclusi **Phys. Rev. Lett., Phys. Rev. X Quantum, Phys. Rev. Res., Phys. Rev. A, IEEE, New J. of Phys. and Phil. Trans. A**. A Barcellona ho insegnato **fisica quantistica** (laurea triennale) e **informatica quantistica** (laurea magistrale), supervisionato **tesi triennali, PhD e di master**. Nel 2021 ho conseguito l'abilitazione in Italia (MAT/07) e in Catalogna. Infine, ho realizzato **divulgazione sulla fisica e informatica quantistica**, mirata a studenti di laurea e scuola superiore (inclusi **Erasmus+ Exchange** and **STEM x change** della Fondazione La Caixa) e ho realizzato con il fumettista **Martoz** un **comic di divulgazione** su questi temi.

Esperienza accademica di ricerca, didattica e divulgazione

- 05/2022 **Einstein International Postdoctoral Fellow - Technische Universität Berlin**,
Con: Prof. A. Pappa, Technische Universität Berlin.
○ finanziato dalla Einstein Foundation con una Fellowship personale.
- 01-04/2022 **Ricercatore post-dottorato - Universitat Autònoma de Barcelona**,
Con: Prof. A. J. Winter, ICREA; Prof. J. C. Calsamiglia, Universitat Autònoma de Barcelona.
○ finanziato da un progetto personale dell'Agenzia Spaziale Europea e dalla Fellowship personale Juan de la Cierva - Incorporación.
- 2020–2021 **Marie Skłodowska Curie (MSC) Fellow - Universitat Autònoma de Barcelona**,
Supervisore: Prof. A. J. Winter, ICREA.
○ Progetto MSC “[“Apprendimento dell'Informazione Quantistica”](#) per la realizzazione di ricevitori quantistici complessi con l'aiuto dell'intelligenza artificiale.
○ Assistente per il corso di Meccanica Quantistica della Laurea Triennale in Fisica.
○ Membro di commissione per tesi di Laurea Triennale in Fisica e Matematica.
○ Supervisore: 1 tesi di Master in Ingegneria Quantistica (UPC). Co-supervisore: 2 tesi di PhD in Fisica, 2 tesi di Laurea Triennale in Fisica.
○ Campi di ricerca: Algoritmi di Decodifica Quantistici, Inferenza Statistica Quantistica, Machine Learning Quantistico, Teoria dell'Informazione e della Comunicazione Quantistica.
○ 6 pubblicazioni (+1 preprint): 2 articoli, 4 atti di conferenze IEEE. 13 collaboratori da Barcelona, Pisa, Monaco, Ulm, Milano, Dresda: professori, post-doc e studenti di PhD/laurea. 14 conferenze scientifiche e visite di ricerca.
○ Revisore per riviste scientifiche internazionali di alto livello: Phys. Rev. Lett., Phys. Rev. X Quantum, Phys. Rev. Res., Phys. Rev. A, IEEE J. Sel. Areas Commun.: special issue Quant. Inf. Science, J. Phys. A, New J. Phys., Phil. Trans. A., Ann. Phys., Eur. J. Phys.
○ Realizzazione di uno [Science Comic](#) sull'Informatica Quantistica con il fumettista Martoz.
- 2017–2019 **Ricercatore post-dottorato - Universitat Autònoma de Barcelona**,
Con: Prof. A. J. Winter, ICREA; Prof. J. C. Calsamiglia, Universitat Autònoma de Barcelona.
○ Assistente per il corso di Meccanica Quantistica della Laurea Triennale in Fisica.
○ Membro di commissione per tesi di Laurea Triennale in Fisica e Matematica.
○ Co-supervisore: 2 tesi di PhD in Fisica, 1 tesi di Laurea Triennale in Fisica.
○ Campi di ricerca: Teorie delle Risorse Quantistiche, Machine Learning Quantistico, Inferenza Statistica Quantistica, Teoria dell'Informazione e della Comunicazione Quantistica.
○ 4 articoli. 8 collaboratori da Barcelona, Pisa, Ulm, Sidney: professori, post-doc e studenti di PhD/laurea triennale. 5 conferenze scientifiche e visite di ricerca.
○ Revisore per riviste scientifiche internazionali di alto livello: Phys. Rev. A, IEEE J. Sel. Areas Commun.: special issue Quant. Inf. Science, J. Phys. A, New J. Phys., Phil. Trans. A., Ann. Phys., Eur. J. Phys.
○ Organizzazione e partecipazione a progetti di divulgazione in fisica quantistica mirati a studenti di Scuola Superiore e Università.

Educazione

- 2014–2017 **Ph.D. in Fisica cum laude**,
Supervisore: Prof. V. Giovannetti, Scuola Normale Superiore, Pisa, Italia,
Tesi Finale: “Protocolli di Decodifica per Comunicazione Classica su Canali Quantistici”.
○ Campi di ricerca: Teoria Quantistica di Shannon e Comunicazione Quantistica, Discriminazione di Stati e Metrologia Quantistiche, Algoritmi di Decodifica Quantistici, Sistemi Quantistici Infinito-Dimensionali, Ottica Quantistica.
○ 5 articoli. 3 collaboratori: professori, post-doc. 14 conferenze scientifiche, scuole e visite di ricerca. 3 corsi di PhD.
○ Tutor per il corso di Meccanica Classica della Lauree Triennali in Matematica, Fisica e Biologia.
○ Corsi di Cinese e ottenimento certificazione di lingua ufficiale.

- 2012–2014 **Laurea Magistrale in Fisica Teorica cum laude**,
Supervisore: Prof. G. Parisi, Università “La Sapienza”, Roma, Italia,
Tesi Finale: “Studio di un modello realistico di Vetro Strutturale in Campo Medio”.
 - Campi di specializzazione: Vetri di Spin e Strutturali, Meccanica Statistica dei Sistemi Disordinati, Materia Condensata e Informazione Quantistica. Relizzazione di simulazioni Monte-Carlo (C/C++). Corso di C++.
 - Partecipazione a un esperimento di Tomografia Quantistica.
 - Riconoscimento “Laureato Eccellente”.
- 2009–2012 **Laurea Triennale in Fisica cum laude**,
Supervisore: Prof. G. Parisi, Università “La Sapienza”, Roma, Italia,
Tesi Finale: “Connessione Preferenziale nelle Reti Complesse”.
 - Campi di specializzazione: Reti Complessi. Simulazioni numeriche dell'evoluzione di reti, considerazione di questioni di ottimizzazione (C).
 - Riconoscimento “Laureato Eccellente”.
- 2004–2009 **Diploma di Maturità Scientifica cum laude**, *Liceo Scientifico “Farnesina”, Roma, Italia*.
 - Piano Nazionale Scientifico con corsi aggiuntivi di Matematica e Fisica.
 - Partecipazione a oltre 10 conferenze di [Simulazione delle Nazioni Unite](#) all'estero in qualità di: delegato, chairman, segretario generale e organizzatore.
 - Programmi di scambio culturale: Pechino e New York.

Finanziamenti e riconoscimenti accademici

- 2022-2026 **Einstein International Postdoctoral Fellowship - Einstein Foundation (EF)** ,
390.154,80 € ,
Ruolo: beneficiario, ricercatore e co-PI. PI: A. Pappa (Technische Universität Berlin).
- 2022-2025 **Juan de la Cierva Incorporación - Ministerio de Ciencia y Innovación, Spain (link)**,
90.000 € ,
Ruolo: beneficiario e ricercatore. PI: A. Winter.
- 2022-2024 **Quantum Information Campaign - Agenzia Spaziale Europea (ESA)**,
90.000 € (+50% co-finanziamento),
Ruolo: beneficiario, ricercatore e co-PI. PI: A. Winter, J. Calsamiglia (Universitat Autònoma de Barcelona).
- 2020-2022 **Marie Skłodowska-Curie Fellowship - Commissione Europea**,
160.932,48 € ,
Progetto n. 845255-QUAIL, “Quantum Information Learning”, Ruolo: beneficiario e ricercatore.
PI: A. Winter (Universitat Autònoma de Barcelona).
- 2020-2022 **Finanziamenti di gruppo - Ministerio de Ciencia, Innovacion y Universidades, Spain**,
129.470 € ,
Progetto PID2019-107609GB-I00, Ruolo: ricercatore e responsabile di un pacchetto di lavoro.
PI: R. Munoz, J. Calsamiglia (Universitat Autònoma de Barcelona).
- 2017-2021 **Finanziamenti di gruppo - MINECO, Spain**,
185.130 € + 211.750 € ,
Progetti FIS2016-80681, FIS2013-40627-P, Ruolo: ricercatore.
PI's: R. Munoz, J. Calsamiglia, A. Sanpera, A. Winter (Universitat Autònoma de Barcelona).
- 2014-2017 **Borsa di Perfezionamento (PhD) - Scuola Normale Superiore di Pisa**.

Abilitazione all'insegnamento accademico

- 2021 **Abilitazione Scientifica Nazionale SC 01/A4 SSD MAT/07, Fisica Matematica II Fascia**,
Ministero dell'Università e della Ricerca, Italia.
- 2021 **Professore Lettore**, Agenzia per la Qualità del Sistema Universitario della Catalogna, Spagna.

Periodi di visita in gruppi di ricerca internazionali

- 11/2022 **Technische Universität München**,
Theoretical Quantum System Design Group, Prof. J. Nötzel.
- 10/2019 **Hong Kong University**,
Quantum Information and Computation Initiative, Prof. G. Chiribella.
- 02/2020 **Scuola Normale Superiore di Pisa**,
Quantum Information Group, Prof. V. Giovannetti.
- 07/2017 **Universitat Autònoma de Barcelona**,
Quantum Information Group, Prof. A. Winter.
- 03/2017 **Max Planck Institut for Quantum Optics Garching**,
Theory Division, Prof. I. Cirac.

Organizzazione di eventi scientifici internazionali

- 2021/22 **2nd Workshop on Entanglement-Assisted Communication Networks (EACN)**,
Physikzentrum DFG, Bad Honnef, Germany.
Technical Program Committee, Local Organization Committee.

Altre esperienze lavorative

- 2010–2017 **Lezioni private**, insegnamento Fisica, Matematica e Chimica a studenti di Scuola Superiore..
- 2009–2013 **Conference manager**, [RIMUN](http://www.rimun.org/), organizzazione di 5 conferenze di Simulazione delle Nazioni Unite; gestione delle attività durante cinque giorni, della sistemazione di centinaia di studenti e docenti presso famiglie locali, del budget, della ricerca di sponsor, della selezione degli argomenti e pianificazione degli eventi; co-realizzazione di un programma in \LaTeX per la formattazione di risoluzioni; fondazione dell'associazione Magistri Vitae per il supporto del progetto nell'ambito dell'Alternanza Scuola-Lavoro (<http://www.magistrivitae.org/>).

Lingue

Italiano: madre lingua. Inglese: avanzato C1 (Cambridge CAE). Tedesco: intermedio B2 (Goethe Zertifikat). Spagnolo: intermedio B2. Francese: base A2. Cinese: base A1 (HSK2).

Abilità informatiche

Livello intermedio di C (corsi di Laurea Triennale), C++ (corso presso Cineca), Wolfram Mathematica, \LaTeX , Microsoft Office, Keynote. Conoscenza base di python. Conoscenza al livello lavorativo dei sistemi operativi Microsoft Windows, Apple OS X and Unix.

Interessi personali e altre informazioni

Ammesso con borsa ai seguenti progetti di PhD (2014): “Reti Complesse” presso IMT Lucca (Supervisore Prof. G. Cardarelli) e “Peripheral nerve decoding algorithms for bioelectronic medicines” presso Imperial College, London (Supervisore Dr. S. Schultz). (rifiutati a favore della borsa in SNS Pisa)

Apprendimento lingue; coltivazione bonsai; pratica di salsa e walzer.

Referenze

Prof. Andreas Winter, andreas.winter@uab.cat.

ICREA & Física Teòrica: Informació i Fenòmens Quàntics, Departament de Física, Universitat Autònoma de Barcelona, ES-08193 Bellaterra (Barcelona), Spain.

Prof. John Calsamiglia, john.calsamiglia@uab.cat.

Física Teòrica: Informació i Fenòmens Quàntics, Departament de Física, Universitat Autònoma de Barcelona, ES-08193 Bellaterra (Barcelona), Spain.

Prof. Vittorio Giovannetti, vittorio.giovannetti@sns.it.

NEST, Scuola Normale Superiore and Istituto Nanoscienze-CNR, I-56126 Pisa, Italy.

Prof. Giorgio Parisi (Premio Nobel in Fisica 2021), giorgio.parisi@roma1.infn.it.

Accademia dei Lincei; Dipartimento di Fisica, Università degli Studi di Roma "La Sapienza", I-00185, Roma, Italy.

Prof. Fabio Sciarrino, fabio.sciarrino@uniroma1.it.

Dipartimento di Fisica, Università degli Studi di Roma "La Sapienza", I-00185, Roma, Italy.

Prof. Janis Nötzel, janis.noetzel@tum.de.

Emmy Noether Group "Theoretical Quantum System Design", Dept. Electrical and Computer Engineering, Technische Universität München.

Lista delle pubblicazioni e preprint

- 1. Reducing energy consumption of fiber networks via quantum communication technology.**
J. Nötzel and M. Rosati, preprint [arXiv:2201.12397](https://arxiv.org/abs/2201.12397).
- 2. Squeezing-enhanced communication on phase-noise channels.**
M. Fanizza, M. Rosati, M. Skotiniotis, J. Calsamiglia, V. Giovannetti, [Quantum 5, 608 \(2021\)](#).
- 3. Reinforcement-learning calibration of coherent-state receivers on variable-loss optical channels.**
M. Bilkis, M. Rosati, J. Calsamiglia, [Proc. 2021 IEEE ITW, 1 \(2021\)](#).
- 4. Compound Channel Capacities under Energy Constraints and Application.**
A. Cacioppo, J. Nötzel and M. Rosati, [Proc. 2021 IEEE ISIT, 640 \(2021\)](#).
- 5. Performance of coherent frequency-shifted keying for classical communication on quantum channels.**
M. Rosati, [Proc. 2021 IEEE ISIT, 902 \(2021\)](#).
- 6. Performance of Gaussian encodings for classical communication on correlated quantum phase-noise channels.**
M. Fanizza, M. Rosati, M. Skotiniotis, J. Calsamiglia, V. Giovannetti, [Proc. 2020 IEEE ISIT, 1830 \(2020\)](#).
- 7. Real-time calibration of coherent-state receivers: learning by trial and error.**
M. Bilkis, M. Rosati, R. Morral Yepes, J. Calsamiglia, [Phys. Rev. Res. 2, 033295 \(2020\)](#).
- 8. Beyond the swap test: optimal estimation of quantum state overlap.**
M. Fanizza, M. Rosati, M. Skotiniotis, J. Calsamiglia, V. Giovannetti, [Phys. Rev. Lett. 124, 060503 \(2020\)](#).
- 9. Accessible coherence in open quantum system dynamics.**
M. G. Díaz, B. Deseff, M. Rosati, D. Egloff, J. Calsamiglia, A. Smirne, M. Skotiniotis, S. F. Huelga, [Quantum 4, 249 \(2020\)](#).
- 10. Using and reusing coherence to realize quantum processes.**
M. G. Díaz, K. Fang, X. Wang, M. Rosati, M. Skotiniotis, J. Calsamiglia, A. Winter, [Quantum 2, 100 \(2018\)](#).
- 11. Narrow Bounds for the Quantum Capacity of Thermal Attenuators.**
M. Rosati, A. Mari and V. Giovannetti, [Nat. Comm. 9, 4339 \(2018\)](#).

12. **Asymmetric information capacities of reciprocal pairs of quantum channels.**
M. Rosati and V. Giovannetti, [Phys. Rev. A **97**, 052318 \(2018\)](#).
13. **Capacity of coherent-state adaptive decoders with interferometry and single-mode detectors.**
M. Rosati, A. Mari and V. Giovannetti, [Phys. Rev. A **96**, 012317 \(2017\)](#).
14. **Optimal quantum state discrimination via nested binary measurements.**
M. Rosati, G. De Palma, A. Mari and V. Giovannetti, [Phys. Rev. A **95**, 042307 \(2017\)](#).
15. **Multi-Phase Hadamard receivers for classical communication on lossy bosonic channels.**
M. Rosati, A. Mari and V. Giovannetti, [Phys. Rev. A **94**, 062325 \(2016\)](#).
16. **Coherent-state discrimination via non-heralded probabilistic amplification.**
M. Rosati, A. Mari and V. Giovannetti, [Phys. Rev. A **93**, 062315 \(2016\)](#).
17. **Achieving the Holevo bound via a bisection decoding protocol.**
M. Rosati and V. Giovannetti, [J. Math. Phys. **57**, 062204 \(2016\)](#).

Attività di relatore in seminari e visite di ricerca, conferenze, workshop e scuole scientifiche internazionali

2021

- invited talk, research visit **Squeezing-enhanced communication without a phase reference**, [Lehrstuhl für Theoretische Informationstechnik](#), Technische Universität Munich.
- invited talk, research visit **Quantum Information Theory with bosonic Gaussian systems and beyond**, [Lehrstuhl für Theoretische Informationstechnik](#), Technische Universität Munich.
- contrib. talk **Reinforcement-learning calibration of coherent-state receivers on variable-loss optical channels**, [IEEE Information Theory Workshop](#), Kanazawa, Japan (online).
- contrib. talk **Squeezing-enhanced communication without a phase reference**, [Deutsche Physikalische Gesellschaft \(DPG\) Meeting](#), Technical University Kaiserslautern, Germany (online).
- contrib. talk **Classical capacity of quantum Gaussian codes: when squeezing helps**, [Quantum Optics X](#), University of Warsaw, Torun, Poland (hybrid).
- contrib. talk by co-author **Compound Channel Capacities under Energy Constraints and Application**, [IEEE International Symposium on Information Theory](#), Sidney (online).
- contrib. talk **Performance of coherent frequency-shifted keying for classical communication on quantum channels**, [IEEE International Symposium on Information Theory](#), Sidney (online).
- invited talk **High-rate classical communication on quantum channels**, [Quantum Communication and Cryptography Group](#), Technische Universität, Berlin (online).
- invited talk **Achieving high-data-rate communication on optical quantum channels**, [Workshop on Entanglement Assisted Communication Networks](#), Technische Universität, Munich (online).
- contrib. talk **Real-time calibration of coherent-state receivers: learning by trial and error**, [Machine Learning for Quantum](#), Heriot-Watt University, Edinburgh (online).
- contrib. talk **Beyond the swap test: optimal estimation of quantum state overlap**, [Quantum Information Days](#), Center for Theoretical Physics, Warsaw (online).

2020

- invited talk **Achieving high-data-rate communication on optical quantum channels**, [Lehrstuhl für Theoretische Informationstechnik](#), Technische Universität, Munich (online).

- contrib. talk **Classical capacity of quantum Gaussian codes: when squeezing helps**, [Q-Turn: changing paradigms in quantum science](#) (online).
- lightning talk by co-author **Classical capacity of quantum Gaussian codes without a phase reference: when squeezing helps**, [Beyond IID in Information Theory 8](#), Stanford (online).
- contrib. talk by co-author **Beyond the swap test: optimal estimation of quantum state overlap**, [15th Conference on the Theory of Quantum Computation, Communication and Cryptography](#), Latvia (online).
- contrib. talk **Performance of Gaussian encodings for classical communication on correlated quantum phase-noise channels**, [IEEE International Symposium on Information Theory](#), Los Angeles (online).
- invited talk **Real-time calibration of coherent-state receivers: learning by trial and error**, [Centre for Quantum Optical Technologies](#), Warsaw (online).
- invited talk, research visit **Using and reusing coherence to realize quantum processes**, [Scuola Normale Superiore](#), Pisa.
- 2019
- invited talk, research visit **Using and reusing coherence to realize quantum processes**, [Quantum Information and Computation Initiative](#), Hong Kong University.
- contrib. talk **Using and reusing coherence to realize quantum processes**, [5th Conference on Quantum Information in Spain](#), Barcelona.
- 2018
- invited talk **Narrow bounds for the quantum capacity of thermal attenuators**, [New Quantum Horizons: from Foundations to Biology](#), INFN Frascati.
- poster **The capacity of coherent-state adaptive decoders with interferometry and single-mode detectors**, [Quantum Controlled Ultrafast Multimode Entanglement and Measurement](#), Oxford.
- poster **Using and reusing coherence to realize quantum processes**, [4th Seefeld workshop on Quantum Information](#), Austria.
- 2017
- contrib. talk **Optimal quantum state discrimination via nested binary measurements**, [10th Italian Quantum Information Science Conference](#), Florence.
- poster **The capacity of coherent-state adaptive decoders with interferometry and single-mode detectors**, [Beyond I.I.D. in Information Theory](#), Singapore.
- invited talk, research visit **Decoding protocols for classical communication on quantum channels**, Quantum Information group, Universitat Autònoma de Barcelona.
- poster **The capacity of coherent-state adaptive decoders with interferometry and single-mode detectors**, [24th Central European Workshop on Quantum Optics](#), DTU Lyngby, Denmark.
- poster **The capacity of coherent-state adaptive decoders with interferometry and single-mode detectors**, [Solstice of Foundations](#), ETH Zurich.
- poster **The capacity of coherent-state adaptive decoders with interferometry and single-mode detectors**, [Theory of Quantum Computation, Communication and Cryptography](#), Paris.
- invited talk, research visit **Decoding protocols for classical communication on quantum channels**, Quantum Information group, Max-Planck-Institut für Quantenoptik, Garching.
- 2016
- poster **Coherent-state discrimination via non-heralded probabilistic amplification**, [International Conference on Quantum Communication, Measurement and Computing \(QCMC\)](#), Singapore.
- poster **Coherent-state discrimination via non-heralded probabilistic amplification**, [23rd Central European Workshop on Quantum Optics \(CEWQO\)](#), Kolymbari, Crete.

poster **Coherent-state discrimination via non-heralded probabilistic amplification**, 619. [Wilhelm und Else Heraeus-Seminar: Quantum Speed Limits](#), Bad Honnef, Germany.

2015

contrib. talk **Achieving the Holevo bound via a bisection decoding protocol**, [Non-Markovian Quantum Dynamics Workshop](#), Cortona, Italy.

poster **Achieving the Holevo bound via a bisection decoding protocol**, [Quantum Key Distribution Summer School](#), IQC, Waterloo, Canada.

poster **Achieving the Holevo bound via a bisection decoding protocol**, [Scientific School in Integrated Quantum Photonics Applications: from Simulation to Sensing](#), Rome, Italy.

poster **Achieving the Holevo bound via a bisection decoding protocol**, [12th Central European Quantum Information Processing Workshop \(CEQIP\)](#), Telc, Czech Republic.



Pablo Villegas

Curriculum Vitae

Personal data

Date and place of birth: June 19, 1988 (El Ejido, Almería, Spain)

Research interests

Statistical physics, phase transitions and criticality, stochastic processes, collective phenomena, biological physics.

Research experience

- Jan 2022 - **Postdoctoral Research Associate**, *Enrico Fermi Center for Study and Today Research (Rome, Italy)*
- Sep 2020 - **Postdoctoral Research Associate**, *Networks Unit, IMT (Lucca, Italy)*
Jan 2022
- Jan 2019 - **Postdoctoral Research Associate**, *Institute for Complex Systems*
Aug 2020 *(ISC-CNR, Rome, Italy)*
- Feb 2018 - **Period of Postdoctoral Orientation (POP)**, *University of Granada*
Jan 2019
- Apr 2015 - **Ph.D. Fellowship (Ministerio de Economía y Competitividad)**,
Feb 2018 *Statistical physics group (University of Granada)*

University studies and diplomas

- Oct 2014 - **PhD in physics**, *University of Granada*, *magna cum laude*
Mar 2018 Dissertation: "*Phases and phase transitions in living matter.*"
Advisor: Miguel Á. Muñoz
- Sep 2014 - **MSc in Teaching Compulsory and Pre-University Secondary**
Sep 2015 **Education, Vocational Training and Language Teaching**, *University of Granada*, *9.1/10*
Thesis: "*Educational applications in Vpython employing cooperative learning.*"
Advisors: Pablo I. Hurtado, Francisco de los Santos
- Sep 2013 - **MSc FisyMat: Biomathematics**, *University of Granada*, *9.7/10*
Jul 2014 Thesis: "*Synchronization: Study and applications of the Kuramoto model.*"
Advisors: Miguel Á. Muñoz, Paolo Moretti



Enrico Fermi Center – Rome – Italy

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Sep 2008 - BSc+MSc in Physics (Licenciado en Física), University of Granada,
Jul 2013 7.5/10

Publications

- 2022 **P. Villegas, T. Gili, A. Gabrielli & G. Caldarelli**, *Characterizing spatial point processes by percolation transitions*, under revision in J. Stat. Mech. Theory Exp.
- 2022 **P. Villegas, T. Gili, A. Gabrielli & G. Caldarelli**, *Laplacian Renormalization Group for heterogeneous networks*, under revision in Nat. Phys. arXiv:2203.07230.
- 2022 **P. Villegas, A. Gabrielli, F. Santucci, G. Caldarelli & T. Gili**, *Path-integral approach to information processing in complex networks: information core emerges from entropic transitions*, under revision in Phys. Rev. Res. arXiv:2202.06669.
- 2022 **V. Buendía, P. Villegas, R. Burioni & M.A. Muñoz**, *The broad edge of synchronization and collective effects in brain networks*, To be published in Phil. Trans. Roy. Soc. A
- 2022 **A. Cavagna, A. Culla, X. Feng, I. Giardina, T.S. Grigera, W. Kion-Crosby, S. Melillo, G. Pisegna, L. Postiglione & P. Villegas**, *Marginal speed confinement resolves the conflict between correlation and control in natural flocks of birds*, Nat. Commun. 13, 2315
- 2021 **P. Villegas, T. Gili & G. Caldarelli**, *Emergent spatial patterns of coexistence in species-rich plant communities*, Phys. Rev. E 104, 034305
- 2021 **V. Buendía, P. Villegas, R. Burioni & M.A. Muñoz**, *Hybrid-type synchronization transitions: Where incipient oscillations, scale-free avalanches, and bistability live together*, Phys. Rev. Res. 3 (2), 023224
- 2021 **A. Cavagna, X. Feng, S. Melillo, L. Parisi, L. Postiglione & P. Villegas**, *CoMo: A novel co-moving 3D camera system*, IEEE Trans. Instrum. Meas., 70, 1-16
- 2021 **P. Villegas, A. Cavagna, M. Cencini, H. Fort & T.S. Griguera**, *Joint assessment of density correlations and fluctuations for analysing spatial tree patterns*, Roy. Soc. Open Sci., 8(1), 202200
- 2020 **V. Buendía, S. di Santo, P. Villegas, R. Burioni & M.A. Muñoz**, *Self-organized bistability and its possible relevance for brain dynamics*, Phys. Rev. Research 2, 013318
- 2020 **P. Villegas, M.A. Muñoz & J.A. Bonachela**, *Evolution in the Debian GNU/Linux software network: analogies and differences with gene regulatory networks*, J. R. Soc. Interface 17 (163), 20190845

- 2019 **V.Buendía, P.Villegas, S.di Santo, A.Vezzani, R.Burioni & M.A.Muñoz**, *Jensen's force and the statistical mechanics of cortical asynchronous states*, Sci. Rep. 9, 15183
- 2019 **P.Villegas, S.di Santo, R.Burioni & M.A.Muñoz**, *Time-series thresholding and the definition of avalanche size*, Phys. Rev. E 100, 012133
- 2018 **S.di Santo, P.Villegas, R.Burioni & M.A.Muñoz**, *Non-normality, reactivity, and intrinsic stochasticity in neural dynamics: a non-equilibrium potential approach*, J. Stat. Mech. Theory Exp., 2018(7), 073402
- 2018 **S.di Santo*, P.Villegas*, R.Burioni & M.A.Muñoz**, *Landau-Ginzburg theory of cortex dynamics: scale-free avalanches emerge at the edge of synchronization*, Proc. Natl. Acad. Sci., 115(7), E1356-E1365. (* Joint 1st authors)
- 2017 **S.di Santo, P.Villegas, R.Burioni & M.A.Muñoz**, *Simple unified view of branching process statistics: Random walks in balanced logarithmic potentials*, Phys. Rev. E, 95(3), 032115
- 2016 **P.Villegas, J.M. Ruiz, J.Hidalgo & M.A.Muñoz**, *Intrinsic noise and deviations from criticality in Boolean gene-regulatory networks*, Sci. Rep. 6, 34743
- 2014 **B.Moglia, E.Albano, P.Villegas & M.A.Muñoz**, *Interfacial depinning transitions in disordered media: revisiting an old puzzle*, J. Stat. Mech. Theory Exp., 2014(10), P10024
- 2014 **P.Villegas, P.Moretti & M.A.Muñoz**, *Frustrated hierarchical synchronization and emergent complexity in the human connectome network*, Sci. Rep. 4, 5990

Proceedings of science conferences

- 2016 **P.Villegas, J.Hidalgo, P.Moretti & M.A.Muñoz**, *Complex synchronization patterns in the human connectome network*, Proceedings of ECCS 2014: European Conference on Complex Systems (pp. 69-80). Springer International Publishing

Contributions to Scientific Conferences

- Sep 2019 **15th Granada Seminar: Stochastic and Collective Effects in Neural Systems**, Granada (Spain), Talk
- Jul 2019 **StatPhys27**, Buenos Aires (Argentina), Attendant
- Jul 2019 **Workshop: Statistical Mechanics of Swarming Behaviour**, La Plata (Argentina), Talk
- Jun 2019 **24rd National Conference on Statistical Physics and Complex Systems**, Parma (Italy), Poster
- Jun 2019 **Statistical mechanics of active matter**, L'Aquila (Italy), Attendant

- Jun 2018 **23rd National Conference on Statistical Physics and Complex Systems**, Parma (Italy), Poster
- Apr 2017 **FISES 2017**, Sevilla (Spain), Poster
- Nov 2016 **III Scientific Conferences of the “Carlos I” Institute of Theoretical and Computational Physics**, Granada (Spain), Poster
- Jun 2016 **Quantitative Laws II: From physiology to ecology, from interaction structures to collective behavior**, Como (Italy), Talk
- May 2016 **I Conferences for young researchers: fostering the interdisciplinarity**, Granada (Spain), Talk
- Oct 2015 **II Scientific Conferences of the “Carlos I” Institute of Theoretical and Computational Physics**, Granada (Spain).
- Oct 2015 **FISES 2015**, Badajoz (Spain), Talk
- Sep 2015 **Net-Works 2015: Complex networks and their interdisciplinary applications**, Granada (Spain). Attendant. Member of the local organizing committee
- Jun 2015 **13th Granada Seminar on Computational and Statistical Physics**, La Herradura (Spain). Member of the local organizing committee, Talk
- May 2015 **BIOMAT: Emergence and self-organization in social and biological systems**, Granada (Spain). Attendant
- Sep 2014 **Summer School on Statistical Physics of Complex Systems**, IFISC, Palma de Mallorca (Spain). Attendant, oral contribution and poster, Poster and talk.

Academic service

- 2018-2019 **Complementary training in physics and chemistry (0.75 cr, MSc in Teaching Compulsory and Pre-University Secondary Education, Vocational Training and Language Teaching)**, *University of Granada*, Spain
- 2017-2018 **Physics of complex systems (1.5 cr, degree in Physics), Computational physics (1.5 cr, degree in Physics)**, *University of Granada*, Spain
- 2016-2017 **Computational physics (2.2 cr, degree in Physics), Statistical physics (1.5 cr, degree in Physics)**, *University of Granada*, Spain
- [Supervision of Master Thesis](#)
- 2018-2019 **From neutral to niche theory**, *Maria Dolores Maldonado-Leza Rodríguez*
- [Co-supervision of PhD Thesis](#)
- 2021-Today **Francesca Santucci**, IMT Lucca

2022-Today **Anna Poggialini**, Enrico Fermi Center for Study and Research

Secondments & short visits

- Nov 2019 **Department of Materials Science**, University of Erlangen-Nürnberg (Germany), invited seminar
- Jul 2019 **IFLYSIB**, University of La Plata (Argentina)
- Jun 2018 **Department of Mathematics, Physics and Computer Science**, University of Parma (Italy)
- May-Aug 2017 **MASTS Marine Population Modelling Group. Department of Mathematics and Statistics**, University of Strathclyde (Glasgow, UK)

Grants

- May-Aug 2017 **Mobility grant**, *University of Strathclyde (Glasgow, UK)*
Advisor: J.A. Bonachela
MASTS Marine Population Modelling Group. Department of Mathematics and Statistics.
Funded by MINECO
- Apr 2015 - **Doctoral grant**, *University of Granada*
Feb 2018 Advisor: Miguel Á. Muñoz.
Grant (FPI programme) at the Dept. Electromagnetism and Matter Physics.
Funded by MINECO

Awards

- Jan 2020 **Seal of excellence: MSCA-IF High Quality Project. “Statistical Mechanics of Tropical Rainforests ”**, (87.0/100), ISC-CNR (Rome, Italy)

Participation in Funded Projects

- Oct 2021 - **Structure and function of cortex neural networks: Connecting**
Jul 2023 **fundamental, biomedical and computational aspects**, *P20_00173*,
Regional Plan of I+D+i Andalucía 2020
- Sep 2021 - **Advances in statistical physics: from fundamentals to the physics**
Sep 2024 **of living systems**, *PID2020-113681GB-I00*, National Plan of I+D+i (MINECO)
- Jan 2019 - **Collective Response from Individual Behavior in Groups and**
Jan 2020 **Ecosystems (CRIB)**, *ELAC2015/T01- 0593. ERANET-LAC 2016 (EU)*
- Jan 2018 - **Frontiers of statistical physics and complex systems: From ba-**
Sep 2021 **sical principles to the last developments in condensed matter, neuroscience and systems biology**, *FIS2017-84256-P*, National Plan of I+D+i (MINECO, Spain)

Apr 2015 - **Statistical physics of complex systems: From basic principles**
Apr 2018 **to the frontiers of matter physics, ecology and neuroscience,**
FIS2013-43201-P, National Plan of I+D+i (MINECO, Spain)

Languages

Spanish: ● ● ● ● ● Mother tongue

English: ● ● ● ● ●

Italian: ● ● ● ● ●

Computer skills

- OS: GNU/Linux, Windows
- Document processing: LyX (L^AT_EX), LibreOffice Writer, Word
- Programming: Fortran, C, Python, L^AT_EX, R
- Parallel computing: OpenMP, PROTEUS (supercomputer center)
- Others: Matlab, Maxima & Mathematica (Computer algebra systems)

Others

- Nov 2018 **Scientific disclosure for researchers: press, TV and radio, 15 hours,**
Granada (Spain). Attendant
- Oct 2018 **Supervision of academic works: PhDs, Master Theses and Gra-**
duate Theses, 20 hours, Granada (Spain). Attendant
- Mar 2016 **Educational tools for peer production, 20 hours,** Granada (Spain).
Attendant
- Sep 2016 **Training days: Initiation to University Teaching for FPU and**
FPI PhD students, 20 hours, Granada (Spain). Attendant
- 2018-Today **Peer Review, *Physical Review Letters, PLoS One, Physica D: Nonlinear***
Phenomena, Neurocomputing, Scientific Reports, Journal of Physics:
Complexity, Cambridge Elements

Last update: May 2022

“Acconsento al trattamento dei dati ai sensi della normativa vigente in materia – Regola-
mento Europeo GDPR 679/2016”

Titoli accademici di Pablo Villegas Góngora

(elencati nel Curriculum Vitae, tradotti in italiano in questa pagina).

1. **Dottorato di ricerca** / International PhD Degree (*Doctor en Física, mención Cum Laude, doctorado internacional*)
Università di Granada (Spagna)
Ottobre 2014 - Febbraio 2018
Tittolo della tesi: “Phases and phase transitions in living systems”
[*Doctor en Física, Granada 15 de Marzo de 2018, registro nacional de títulos 2018/151039*]
2. **Master in formazione degli insegnanti e la scuola secondaria obbligatoria, la formazione professionale e l’insegnamento delle lingue** (*MSc in Teaching Compulsory and Pre-University Secondary Education, Vocational Training and Language Teaching*)
Università di Granada (Spagna)
Settembre 2014 - Settembre 2015
[*Máster Universitario en Física y Matemáticas: Especialidad en Biomatemáticas, Granada 30 de Julio de 2015, registro nacional de títulos 2015/167611*]
3. **Master di specializzazione in fisica e matematica: FisyMat** (*MSc FisyMat: Biomathematics*)
Università di Granada (Spagna)
Settembre 2013 - Luglio 2014
[*Máster Universitario en Profesorado de Enseñanza Secundaria Obligatoria y Bachillerato, Formación Profesional y Enseñanza de Idiomas, Granada 13 de Noviembre de 2015, registro nacional de títulos*]
4. **Laurea in Fisica** (*Licenciatura en física*)
Università di Granada (Spagna)
Settembre 2008 - Luglio 2013
[*Licenciado en Física, Granada 29 de Julio de 2013, registro nacional de títulos 2013/223320*]
[*Titolo equivalente alla Laurea in Fisica, come attestato dalla “Dichiarazione di valore” rilasciata dal Console Generale d’Italia, Sergio Barbanti, il 20 settembre 2005.*]



Enrico Fermi Center – Rome – Italy

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