Curriculum Vitae

1 Basic information

Male Italian
Avenue de la Poste, 18, Renens, 1020, Switzerland +41767794367
Ecole Polytechnique Federal de Lausanne, 1015 Lausanne, Switzerland
marco.scigliuzzo@epfl.ch marco.scigliuzzo.physics@gmail.com
Postdoctoral researcher in prof. Kippenberg's group. From 11/2021 – Now.
Career break 1 month (June 2022), birth of son (Leonardo Alan Scigliuzzo).
Personal website: https://scigliuzzo.netlify.app

2 Higher education degrees and evaluations

PhD in quantum optics (3rd September 2021). *Chalmers University of Technology*, Sweden. Supervisor: Per Delsing. Thesis: Effects of the environment on quantum systems. ISBN: 978-91-7905-534-9 .

M.Sc. Physics (22nd February 2016). *University of Salento*, Italy. 110/110 Magna cum Laude. Supervisor: Giuseppe Maruccio. Thesis: Optimization of SAW filters and resonators. DOI

3 Main Scientific Achievements

All citations refer to the "list of publications" section.

Figure 1: Optomechanical hexamer

Quantum optics and quantum acoustic - I have made widely recognized contributions to circuit quantum electrodynamics and acoustodynamics, particularly in the ability to control photonic [10,11] and phononic [9,16,17] degrees of freedom in artificial systems at the quantum level. In the electromagnetic domain, I demonstrated frequency and time-domain control of a delocalized atomic excitation (atom-photon bound state) [11]. This work has opened new directions in qubit bath engineering and enabled the simulation of spin chains with all-to-all connectivity. I also contributed to implementing a Selective Number-dependent Arbitrary Phase (SNAP) gate, which generated Wigner-negative states. This technique, used to realize cubic phase states in an aluminum three-dimensional cavity for the first time [10], demonstrated full control of a universal set of quantum gates. In mechanical systems, I achieved two-mode squeezing and multimode entanglement in surface acoustic wave (SAW) resonators [9], leveraging Kerr nonlinearity for mechanical modes. During my postdoc, I contributed to advancing circuit optomechanics by developing a theoretical scheme to sense oscillations of ultra-strong vacuum via the generation of mechanical excitations [16]. This method provided measurable effects for vacuum fluctuations. Additionally, I prepared and measured the ground state of a collective ensemble (N=6) of mechanical resonators [17], observing quantum-mechanical sideband asymmetry and $\sqrt{N}$ enhancement of optomechanical coupling—paving the way for multipartite entanglement and quantum metrology advancements.

High coherence devices - I have made critical contributions to understanding and mitigating sources of decoherence in superconducting circuits, spanning phononic [4,15], photonic [5], and two-level systems

(TLS) [3] loss channels. I introduced lower bounds on losses arising from electromechanical conversion in superconducting devices fabricated on piezoelectric substrates [4]. This work has alerted the community to the importance of decoupling electric fields from piezoelectric materials to optimize superconducting and hybrid platforms (e.g., microwave-to-optical converters). I also contributed to studies showing the temporal fluctuations of TLS, highlighting the necessity for long-term statistics to fully characterize qubit coherence times [3]. This has raised awareness within the circuit QED community about the importance of statistical approaches in evaluating qubit performance. Additionally, I developed a method for mechanically switching off TLS loss channels using SAW resonators, and I introduced a qubit-photonic bath thermometer based on the thermal bath's effect on the coherence of a strongly coupled qubit [5]. This tool is now a crucial asset for quantum thermodynamics experiments. During my postdoc, I contributed to the discovery of mechanical shock effects on superconducting qubits [15], further emphasizing the need for phononic shielding in quantum technologies.

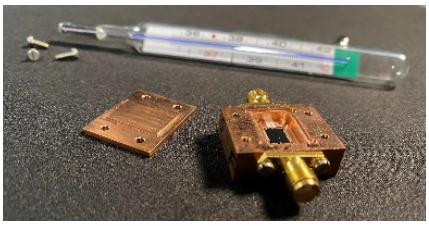


Figure 2 *Packaged thermometer qubit.*

Fabrication and improvements of superconducting circuits - I played a key role in advancing state-of-the-art fabrication processes now widely used in the superconducting technologies community. I contributed to the development of a three-angle evaporation method for in-situ bandaging of Josephson junctions [6]. This process, now adopted across the field, eliminates an additional lithography step and reduces contamination risks from the lift-off process. Additionally, I successfully replicated the fabrication of a traveling-wave parametric amplifier based on trilayer Nb/AlOx/Nb Josephson junctions at EPFL. Though the process itself is not new, its successful implementation enables the creation of compact, low-loss metamaterials for quantum applications. Finally, in [14,19] I contributed to developed high kinetic inductance materials at EPFL, successfully used them to study disorder in coupled cavity arrays and currently integrating them with standard aluminum fabrication [23].

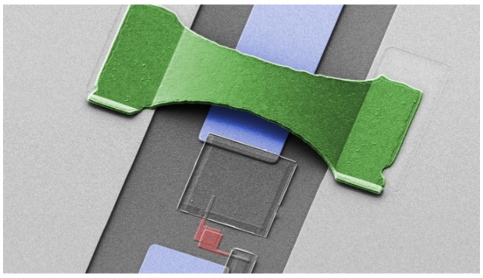


Figure 3*. Josephson Junction under a bridge.*

4 List of Publications

Metrics: citations 1122, H-index 15, i10-Index 17 (from Google Scholar on 3th October 2025).

Preprints in review

23. V. Jouanny, L. Peyruchat, M. **Scigliuzzo**, A. Mercurio, E. Di Benedetto, D. De Bernardis, D. Sbroggiò, S. Frasca, V. Savona, F. Ciccarello and P. Scarlino. Superstrong Dynamics and Chiral Emission of a Giant Atom in a Structured Bath. *https://arxiv.org/abs/2509.01579*

22. M **Scigliuzzo***, L. Peyruchat*, RM Marabini, C. Becker, V. Jouanny, P. Delsing, P. Scarlino. Quantum Acoustics with Tunable Nonlinearity in the Superstrong Coupling Regime. *https://arxiv.org/abs/2505.24865*

EPFL affiliation (Postdoctoral researcher)

21. M Chegnizadeh*, A Youssefi*, M **Scigliuzzo**, Tobias J. Kippenberg. Compact superconducting vacuum-gap capacitors with low microwave loss and high mechanical coherence for scalable quantum circuits. Phys. Rev. Applied 23, 064071 (2025) DOI

20. V. Jouanny, S. Frasca, V.J. Weibel, L. Peyruchat, M. **Scigliuzzo**, F. Oppliger, F. De Palma, D. Sbroggio, G. Beaulieu, O. Zilberberg, and P. Scarlino. High kinetic inductance cavity arrays for compact band engineering and topology-based disorder meters. Nature Communications 16, 3396 (2025) DOI

19. L Peyruchat, F Minganti, M **Scigliuzzo**, F Ferrari, V Jouanny, F Nori, V Savona, and P Scarlino. Landau-Zener without a Qubit: Unveiling Multiphotonic Interference, Synthetic Floquet Dimensions, and Dissipative Quantum Chaos. npj Quantum Information 11, 62 (2025) DOI

18. G Beaulieu, F Minganti, S Frasca, M **Scigliuzzo**, S Felicetti, R Di Candia, P Scarlino. Criticality-Enhanced Quantum Sensing with a Parametric Superconducting Resonator.PRX Quantum 6, 020301 (2025) DOI

17. M Chegnizadeh*, M **Scigliuzzo***, A Youssefi, S Kono, E Guzovskii and T. J. Kippenberg. Quantum collective motion of macroscopic mechanical oscillators. Science 386 (6728), 1383-1388 (2024) DOI

16. F Minganti, A Mercurio, F Mauceri, M **Scigliuzzo**, S Savasta, V Savona. Phonon Pumping by Modulating the Ultrastrong Vacuum. SciPost Physics 17 (1), 027 (2024). DOI

15. S Kono, J Pan, M Chegnizadeh, X Wang, A Youssefi, M **Scigliuzzo**, T J Kippenberg. Mechanically Induced Correlated Errors on Superconducting Qubits with Relaxation Times Exceeding 0.4 Milliseconds. Nature Communications 15 (1), 3950 (2024). DOI

14. S Frasca, I N Arabadzhiev, S Yves Bros de Puechredon, F Oppliger, V Jouanny, R Musio, M **Scigliuzzo**, F Minganti, P Scarlino, and E Charbon. High-Kinetic Inductance NbN Films for High-Quality Compact Superconducting Resonators. Physical Review Applied 20 (4), 044021 (2023). DOI

13. A Osman, J Fernàndez-Pendàs, C Warren, S Kosen, M **Scigliuzzo**, A Frisk Kockum, G Tancredi, A Fadavi Roudsari, and J Bylander. Mitigation of Frequency Collisions in Superconducting Quantum Processors. Physical Review Research 5 (4), 043001 (2023). DOI

Chalmers affiliation (PhD student)

12. A M Ali, C Castillo Moreno, S Sundelin, J Biznárová, M **Scigliuzzo**, K Patel, A Osman, D P Lozano, I Strandberg, and S Gasparinetti. Engineering Symmetry-Selective Couplings of a Superconducting Artificial Molecule to Microwave Waveguides. *Physical Review Letters* 129, 12 123604 (2022). DOI

11.M **Scigliuzzo**, G Calajò, F Ciccarello, D P Lozano, A Bengtsson, P Scarlino, A Wallraff, D Chang, P Delsing, and S Gasparinetti. Controlling Atom-Photon Bound States in an Array of Josephson-Junction Resonators. *Physical Review X* 12, 3, 031036 (2022). DOI

10. M Kudra, M Kervinen, I Strandberg, S Ahmed, M **Scigliuzzo**, A Osman, D Pérez Lozano, G Ferrini, J Bylander, …, and S Gasparinetti. Robust Preparation of Wigner-Negative States with Optimized SNAP-Displacement Sequences. *PRX Quantum* 3, 3, 030301 (2022). DOI

9. G Andersson, S W Jolin, M **Scigliuzzo**, R Borgani, M O Tholén, J C. Rivera Hernández, V Shumeiko, D B Haviland, and P Delsing. Squeezing and Multimode Entanglement of Surface Acoustic Wave Phonons. *PRX Quantum* 3, 1, 010312 (2022). DOI

8. Y Lu, A Bengtsson, J J Burnett, B Suri, S R Sathyamoorthy, H Renberg Nilsson, M **Scigliuzzo**, J Bylander, G Johansson, and P Delsing. Quantum Efficiency, Purity and Stability of a Tunable, Narrowband Microwave Single-Photon Source. *Npj Quantum Information* 7, 1, 1–8 (2021). DOI

7. G Andersson, A L O Bilobran, M **Scigliuzzo**, M M de Lima, J H Cole, and P Delsing. Acoustic Spectral Hole-Burning in a Two-Level System Ensemble. *Npj Quantum Information* 7, 1, 1–5 (2021). DOI

6. A Osman, J Simon, A Bengtsson, S Kosen, P Krantz, D P Lozano, M **Scigliuzzo**, P Delsing, J Bylander, and A Fadavi Roudsari. Simplified Josephson-Junction Fabrication Process for Reproducibly High-Performance Superconducting Qubits. *Applied Physics Letters* 118, 6, 064002 (2021). DOI

5. M **Scigliuzzo**, A Bengtsson, J Besse, A Wallraff, P Delsing, and S Gasparinetti. Primary Thermometry of Propagating Microwaves in the Quantum Regime. *Physical Review X* 10, 4, 041054 (2020). DOI

4. M **Scigliuzzo**, L E Bruhat, A Bengtsson, J J Burnett, A Fadavi Roudsari, and P Delsing. Phononic Loss in Superconducting Resonators on Piezoelectric Substrates. *New Journal of Physics* 22, 5, 053027 (2020). DOI

3. J J Burnett, A Bengtsson, M **Scigliuzzo**, D Niepce, M Kudra, P Delsing, and J Bylander. Decoherence Benchmarking of Superconducting Qubits. *Npj Quantum Information* 5, 1, 1–8 (2019). DOI

Unisalento affiliation (Master student)

2. C Maruccio, M **Scigliuzzo**, S Rizzato, P Scarlino, G Quaranta, M S Chiriaco, A G Monteduro, and G Maruccio. Frequency and Time Domain Analysis of Surface Acoustic Wave Propagation on a Piezoelectric Gallium Arsenide Substrate: A Computational Insight. *Journal of Intelligent Material Systems and Structures* 30, 6, 801–12 (2019). DOI

1. S Rizzato, M **Scigliuzzo**, M S Chiriacò, P Scarlino, A G Monteduro, C Maruccio, Tasco, and G Maruccio. Excitation and Time Resolved Spectroscopy of SAW Harmonics up to GHz Regime in Photolithographed GaAs Devices. *Journal of Micromechanics and Microengineering* 27, 12 ,125002 (2017). DOI

5 Patents

1.**EP25164232.8**, Impedance modulated Josephson traveling wave parametric amplifier
Inventors: E. Guzovskii (10%) / T. Kippenberg (30%) / H. Li (30%) / M. Scigliuzzo (30%)

2. **EP25175601.1**, Wafer substrates with intrinsic Phononic bandgap
Inventors: G. Arregui Bravo (10%) / T. Kippenberg (30%) / S. Kono (30%) / M. Scigliuzzo (30%)

6 Research funding and grants

Innosuisse Switzerland-Korea Call 2024: *Quantum limited amplifiers with engineered pump.* **Applicant/Project manager: M Scigliuzzo**. I contributed to write and justified the grant request for studying new pumping scheme in traveling wave parametric amplifiers. **Funded for 3 years (Total all partners: 1.85M CHF, EPFL allocation 620k CHF)**. (see confirmation letter in the attachments)

Quantum center EPLF postdoctoral fellowship: *Exotic quantum states in circuit optomechanics.* **Main applicant: M Scigliuzzo**. I wrote and justified the grant request studying non-classical state generation on optomechanical system. **Funded for 2 years (200k CHF)**. (see confirmation letter in the attachments)

EPFL Equipment: *Superconducting qubit and optomechanics control and readout system.* Main applicant: prof. Kippenberg, **Support: M Scigliuzzo**. I wrote and justified the grant request for acquiring a fast time-domain setup for qubit and optomechanics measurements. I determined the technical specifications of the equipment, carried on the acceptance. **Funded 130.4k CHF**.

EPFL Equipment: *Sputtering deposition system for superconducting films and controllable oxidation.* Main applicant: prof. Kippenberg **Support: M Scigliuzzo**. I contributed to write the grant request. I wrote the tender technical specification, and I was responsible for technical inquiries during the tender. **Funded 600k CHF**.

SNF 'REQUIP *Fast turn-around dilution refrigerator for superconducting quantum circuit prototyping.* SNF Equipment Funding. Main applicant: prof. Kippenberg **Support: M Scigliuzzo**. I wrote and justified the grant request for acquiring a dilution refrigerator with short (<12h) cooldown and warm-up times. I determined the technical specifications of the equipment, and I was the responsible for technical inquiries during the tender. **Funded 382k CHF**

2.6 Research supervision and leadership experience

During my PhD and my postdoc I had experience in **supervising master students**:

- Aprameyan Desikan, *Development of precise control of flip chip process for superconducting circuits.* EPFL

(2024-2025).
- Constantin Mario Wehrbach, *Matrix-Product-State Simulation and Design of a Josephson Traveling-Wave Photon Detector*. EPFL (2023-2024).
- Hugo Arbez, *Time domain optomechanics with Quantum Machines*. EPFL (2022-2023).
- Kowshik E. Patel, *Engineering decay rates of Hybridised modes in Superconducting circuits*. Chalmers University (2019–2020).
- Vukan Levajac, *Measuring Coherence of a Coaxmon*. Chalmers University (2017–2018)

And **PhD students**:
- Jiaheng Wang. Circuit optomechanics. EPFL (2023–Now).
- Xuxin Wang. Superconducting qubit on Sapphire (2024-Now)
- Mahdi Chegnizadeh. Circuit optomechanics. EPFL (2021–Now).
- Evgenii Guzovskii. HBAR coupled to superconducting qubits. EPFL (2021–Now).
- Hao Li. Traveling wave parametric amplifiers. EPFL (2021–Now).
- Amir Youssefi. Circuit optomechanics. EPFL (2021–2024).

List of teaching

During the course of more than seven years I acquired a large set of skills as teaching assistant and supervisors of students. I taught in a **total of ten courses** on all levels, in particular two for **bachelor level**:

- *Physics and chemistry for civil engineers (BOM 221).* Chalmers Bachelor Program, for academic year *2017 – 2018 and 2018 – 2019.* In person lecture of elementary thermodynamic exercises.

Seven courses on **master level**:

- *Superconductivity and Low Temperature Physics (FMI036).* Chalmers Master Program, for academic year *2016 – 2017, 2017 – 2018 and 2018 – 2019.* Exercises correction and in person High-Tc SQUID laboratory session.
- *Quantum Optics and Quantum Informatics* (FKA173). Chalmers Master Program, for academic year 2017 – 2018, 2018 – 2019. And 2020 – 2020. In person lecture on quantum optics exercises, in person laboratory on qubit characterization, and hand-in correction.
- *Modeling and fabrication of micro/nanodevices* (MCC115). Chalmers Master Program, for academic year 2017 – 2018. In person supervision of nanofabrication project in the cleanroom.

And one course on **PhD level**:

- *Hands-on Quantum Technology*. WACQT PhD Program, for academic year *2020– 2021.* In person exercise and laboratory on qubit characterization.

Selected talks

14. ***APS March Meeting*** 🔗-Towards higher qubit-phonon coupling in a flip-chip architecture transmon-HBAR system. (USA 2025)

13. ***APS March Meeting*** 🔗-Quantum collective motion of macroscopic mechanical oscillators. (USA 2025)

12. ***Research seminar at Syracuse University*** **(invited)** - Exotic Multimode Quantum Systems: Interactions of Light, Sound, and Matter. (USA 2025)

11. ***Micromechanics Conference*** **(invited*)** 🔗- Ultra coherent circuit optomechanics: From watching decoherence of a squeezed mechanical oscillator to collective ground state cooling. (Austria 2025)

10. ***Research seminar at QuTech* (invited)** - Exotic Multimode Quantum Systems: Interactions of Light, Sound, and Matter. (Netherland 2025)

9. ***Research Seminar at Institute Quantique* (invited)** - Exotic Multimode Quantum Systems: Interactions of Light, Sound, and Matter. (Canada 2025)

8. ***2nd International Workshop on Quantum Optics with Giant Atomic Emitters* (Invited*)** – Compact high impedance cavity array collectively coupled to qubit. (Sweden 2024)

7. ***Collective phenomena workshop* (invited)** - Ground State Cooling and Emission Enhancement in Collective Mechanical Modes. (Germany 2024) (video available at https://youtu.be/O4JVBfz6w2s?si=TVG2G6YBv-3oZDRC)

6. ***QSE Center General Assembly* (invited)** - Exotic mechanical states in circuits optomechanics. (Switzerland 2024)

5. ***APS March Meeting*** - Progress towards a near quantum-limited Josephson travelling wave parametric amplifier based on Nb-Al/Al2O3-Nb trilayer technology. (USA 2023) (video available at https://www.youtube.com/watch?v=i6MOBezLl6k)

4. ***APS March Meeting*** - Collective dynamics in circuit optomechanical systems. (USA 2023), (video available at https://www.youtube.com/watch?v=9sjCnvt6Np)

3. ***APS March Meeting*** - Probing nonlinear photon scattering with artificial atoms coupled to a slow-light waveguide. (Virtual 2021)

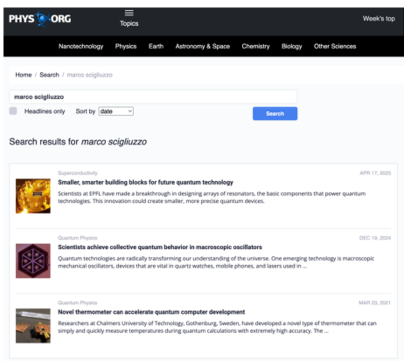
2. ***WACQT e-meeting* (invited)** - Scalable quantum simulation architecture based on atom-photon bound states in an array of high-impedance resonators. (Virtual 2021)

1. ***APS March Meeting*** - Phononic Losses in Superconducting Coplanar Waveguide Resonators on Piezoelectric Substrates. (USA 2019).

*On these occasions, I replaced the originally invited collaborators

Services

Press Release – The most important publication and Grant awards were covered in press release:



5. ***Smaller, smarter building blocks for future quantum technology*** (2025). Related to [19]

4. ***Macroscopic oscillators move as one at the quantum level*** (2025). Related to [17]

3. ***EPFL, Zurich Instr, WithWave, SKKU partner for new quantum amplifiers*** (2024).

2. ***Unprecedented control over captured light*** (2022). Related to [10]

1. ***Novel thermometer can accelerate quantum computer development*** (2021). Related to [4]

Service activity -I am actively involved in community service activity, both as reviewer and for outreach purposes (in parenthesis the number of occurrences).

- *Reviewer* for Nature Physics (1), PRX (1), Nature Communication (2), PRX Quantum (3), PR Letter (1), PR applied (1), Communication Physics (1), Scientific Report (1).
- *Consultant* for issue of "Superconductor Week" (1).

- *Quantum Scientist To-Go!* Organized by American Physical Society (APS) (1).
- *Outreach event at EPFL (*3rd year Bachelor students*)* (2).

References

For additional references, please contact my current and former supervisors:

- Prof. **Tobias J Kippenberg**, EPFL, tobias.kippenberg@epfl.ch
- Prof. **Per Delsing**, Chalmers, per.delsing@chalmers.se
- Prof. Giuseppe Maruccio, Unisalento, giuseppe.maruccio@unisalento.it

Or former and current collaborators:

- Prof. **Pasquale Scarlino**, EPFL, pasquale.scarlino@epfl.ch
- Prof. **Vincenzo Savona**, EPFL, vincenzo.savona@epfl.ch
- Prof. Simone Gasparinetti, Chalmers, simoneg@chalmers.se
- Prof. Luigi Martina, Unisalento, Luigi.Martina@le.infn.it