Jean-Claude Besse

ETH Zürich, HPF D2
Otto-Stern-Weg 1
8093 Zurich CH

Phone: +41.44.633.25.04

Email: jbesse@phys.ethz.ch
URL: https://jcbesse.ch
ORCID: 0000-0002-1490-0072

Born: July 9, 1992
Nationality: Swiss
Academic age: 3 years

Current position

2021-cur
2 years
Senior Researcher, ETH-PSI Quantum Computing Hub
Fabrication, Modular Quantum Computing, Quantum Optics and Communication.

Areas of specialisation

Quantum Computing; Quantum Optics; Superconducting Circuits; Nano-Fabrication

Past Appointments

2021-2021
1 year
Postdoctoral Researcher, ETH Zurich
Quantum Device Lab / Andreas Wallraff.

2016-2021
5 year
PhD Student, ETH Zurich
Quantum Device Lab / Andreas Wallraff.

Education

2016-2021
PhD, ETH Zurich
Thesis: *Generation, Manipulation, and Detection of Complex States of Microwave Radiation.* Andreas Wallraff, ETH Zurich.
Awarded the ETH medal for outstanding PhD Thesis.

2013-2015
MSc Physics, ETH Zurich. GPA: 5.92/6.00
Master thesis: *Design, optimization and measurements of 2D photonic crystals with high photon-phonon cooperativity.* Oskar Painter, Caltech.

Semester thesis: *Piezoelectric actuation of GaAs NEMS.* Ataç İmamoğlu, ETH Zurich.

2013 *International Diploma*, Imperial College London. GPA: 89/100
Bachelor thesis: *Automated High-Resolution Structured Illumination Microscopy.* Peter Török, Imperial College.

2010-2013 *BSc Physics*, EPFL. GPA: 5.90/6.00. Second-best GPA award.
Summer project: *External Cavity Diode Laser.* Tobias Kippenberg, EPFL.

Publications & talks

22 published articles (2 Nature, 3 first-author publications), >1500 citations total and h-index of 17 on Google Scholar. More than 20 contributed and invited talks.

Major Achievement 1

Generation and detection of itinerant microwave radiation.
In my PhD work, I led the effort on the detection [1] of individual itinerant microwave photons generated by a quantum source that we also developed and characterized [2]. This work was extended to realize a parity detector, that has been used to herald propagating cat states of microwave light [3]. A clicking detector, sensitive to parity of the incoming radiation field, may prove useful in distributed error-corrected communication protocols.

[1] Besse, J.-C., Gasparinetti, S., Collodo, M. C., Walter, T., Kurpiers, P., Pechal, M., Eichler, C. and Wallraff, A. (2017). Single-Shot Quantum Nondemolition Detection of Individual Itinerant Microwave Photons. Physical Review X 8, 021003. Open Access article.
[2] Pechal, M., Besse, J.-C., Mondal, M., Oppliger, M., Gasparinetti, S. and Wallraff, A. (2016). Superconducting Switch for Fast On-Chip Routing of Quantum Microwave Fields. Physical Review Applied, 6(2), 024009. Article. Open Access.
[3] Besse, J.-C., Gasparinetti, S., Collodo, M. C., Walter, T., Remm, A., Krause, J., Eichler, C. and Wallraff, A. (2020). Parity Detection of Propagating Microwave Fields. Physical Review X 10, 011046. Open Access article.

Major Achievement 2

Quantum networks.
I have contributed, mostly in the nano-fabrication aspects, to a multi-year long effort geared at realizing non-local microwave quantum networks. This include the deterministic remote entanglement between superconducting qubits located physically on separated quantum devices [1], the engineering of a microwave quantum link allowing these two devices to be located in separate cryogenic systems [2], and the loophole-free experimental violation of a Bell-inequality with a solid-state sytem [3].

[1] Kurpiers, P., Magnard, P., Walter, T., Royer, B., Pechal, M., Heinsoo, J., Salathe, Y., Akin, A., Storz, S., Besse, J.-C., Gasparinetti, S., Blais, A., and Wallraff, A. (2018). Deterministic quantum state transfer and remote entanglement using microwave photons. Nature, 558, 264–267. Open Access article.

[2] Magnard, P., Storz, S., Kurpiers, P., Schär, J., Marxer, F., Lütolf, J., Walter, T., Besse, J.-C., Gabureac, M., Reuer, K., Akin, A., Royer, B., Blais, A. and Wallraff, A. (2020). Microwave Quantum Link between Superconducting Circuits Housed in Spatially Separated Cryogenic Systems. Phys. Rev. Lett., 125, 260502. Article. Open Access.

[3] Storz, S., Schär, J., Kulikov, A., Magnard, P., Kurpiers, P., Lütolf, J., ... Wallraff, A. (2023). Loophole-free Bell inequality violation with superconducting circuits. Nature, 617(7960), 265–270. Open Access article.

Teaching

Lecturer for postgraduate students at ETH Zurich, on *Quantum Science with Superconducting Circuits* (2x, ca. 80 students) and *Quantum Information Processing II: Implementations* (2x, ca. 140 students).
Teaching assistant for undergraduate students at EPFL and ETH Zurich on Informatique, Physik I, Physik II.
Supervision of ca. 10 semester and master theses.

Services

Reviewer for PRX, PRX Quantum, Nature Communications, PRL, PRApplied, PRA, PRB, npjQI, ... (ca. 4 articles per year).

Last updated: November 28, 2023