Ivan Rojkov

Postdoctoral researcher · Trapped Ion Quantum Information group

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Personal

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Education

FEB 2021 - JUL 2025
PhD Physics, *Eidgenössische Technische Hochschule Zürich (ETH Zürich)*
- PhD thesis: "*Steering quantum information into logical subspaces using dissipation*"
- Advisors: Prof. Jonathan Home, Dr. Florentin Reiter
- Committee: Prof. Liang Jiang (examiner), Prof. Eugene Demler (chair)

SEP 2019 - JAN 2021
MSc Physics, *Eidgenössische Technische Hochschule Zürich (ETH Zürich)*
- MSc thesis: "*Bias in error-corrected quantum sensing*"
- Advisors: Prof. Jonathan Home, Dr. Florentin Reiter

SEP 2016 - JUL 2019
BSc Physics, *École Polytechnique de Lausanne (EPFL)*

Experience

** research; + professional*

FEB 2021 - NOV 2025
Research assistant *, *Trapped Ion Quantum Information group, ETH Zürich*
- Taught 8 semesters across 5 different courses.
- Co-supervised 5 undergraduate students, with 3 projects leading to publications.
- Contributed to 9 research manuscripts, including 5 as first author.
- Contributed to 5 successful grant proposals supporting research and scientific event organization.

OCT 2019 - NOV 2020
Research assistant *, *BachLab, University of Zürich*
- Advisor: Prof. Dominik R. Bach
- Developed and maintained Matlab toolbox for the analysis of physiological signals [1 publication].
- Adapted and maintained the semi-automatic anonymization of data sets for open data repository.

AUG 2014 - AUG 2019
Administrative assistant +, *Osteopathic Permanence of Geneva*

JUL 2019
Research assistant *, *Trisconne group, Department of Quantum Matter Physics, University of Geneva*
- Advisors: Prof. Jean-Marc Triscone, Dr. Marios Hadjimichael, Dr. Adrien Waelchli
- Fabricated oxide heterostructures via PLD and tested their high-$\mathrm{T_c}$ superconductivity.

APR 2016 - SEP 2016 + SUMMERS 2017 & 2018
Research assistant *, *Alpha Magnetic Spectrometer (AMS-02), CERN*
- Advisors: Prof. Samuel Ting, Dr. Michael Capell

Awards & Grants

2025	**Nominated for the ETH Medal**, *ETH Zürich* Annual honor granted to the top 8% of all PhD theses at ETH Zurich.	
2025	**Postdoc.Mobility**, *Swiss National Science Foundation (SNSF)* Postdoctoral fellowship awarded for 24 months to work with Steve Girvin and Shruti Puri at Yale University [35% success rate, direct acceptance (top 12%)].	*CHF 128'000*
2025	**Monte Verità Conference**, *Congressi Stefano Franscini* Grant obtained with Jonathan Home, Andreas Wallraff, Alexander Grimm, Joseph Rennes, Jonathan Conrad, and Alfredo Ricci Vásquez to organize the Monte Verità Quantum Codes (MVQC) conference 2026.	*CHF 17'000*
2022	**ETH-EPFL Summer Schools grant**, *EPFL & ETH Zürich* Lead applicant for the grant awarded with Stefano Barison, Alfredo Ricci Vásquez, David Schlegel, Gillenhaal Beck, and Moritz Fontboté-Schmidt, to organize the Quantum Computing Hard- and Software summer school 2022.	*CHF 20'000*
2015	**Prix de l'Université de Genève**, *University of Geneva* **Prix Marc Birkigt**, *Collège de Genève* Awards received prior starting the BSc.	*CHF 500* *CHF 300*

Selected Projects

Scalable dissipative QEC and algorithms [3, 4]: Demonstrated that trickle-down error correction, akin to a cooling process, exponentially reduces the number of correction operators and extends logical qubit lifetimes. Likewise, proved that targeted qubit resets within variational circuits can prevent barren plateaus.

Nonlinear reservoir engineering [1, 7]: Introduced a new paradigm for reservoir engineering in strongly nonlinear regimes, enabling the stabilization of bosonic Schrödinger-cat codes and autonomous error correction. Collaborated on the experimental realization of these schemes in a trapped-ion system operated outside the Lamb–Dicke regime.

Logical gate on approximate codes [6]: Quantified errors in logical two-GKP-qubit gates arising from approximate codewords and showed their correction using QEC without altering much the logical information.

Bias in error-corrected sensing [9]: Proved that finite-speed quantum error correction biases the outputs of quantum sensors, challenging the widely adopted assumption of infinitely fast correction.

Mentoring

Spring 2025	**Sergey Ermakov**, *Semester project (co-supervision with L. Fioroni)* "*Entanglement quantification and structural decomposition using SWAP tests*"
Spring 2024	**Frederik van der Brugge**, *MSc Thesis* "*Dissipatively stabilized cat qudits for analog quantum simulation*"
Spring 2023	**Lorenzo Fioroni**, *MSc Thesis* "*QMLA method for quantum Liouvillian learning*"
Fall 2022	**Noah Kaufmann**, *MSc Thesis* "*Noise Characterization of Near-Term Quantum Devices*"
Spring 2022	**Paul Moser Röggla**, *MSc Thesis* "*Two qubit gates for Gottesmann-Kitaev-Preskill states*"
Spring 2021	**Gerard Aguilar Tapia**, *Semester project* "*Study of the efficiency of GKP codes to correct various oscillator error models*"

Teaching Experience

Spring 2025	**Energy and Sustainability in the 21st Century (II)**, *Teaching Assistant*	*ETH Zürich*
Fall 2024	**Energy and Sustainability in the 21st Century (I)**, *Teaching Assistant*	*ETH Zürich*
Spring 2024	**Physics Lab 1**, *Teaching Assistant*	*ETH Zürich*
Fall 2023	**Physics Lab 1**, *Teaching Assistant*	*ETH Zürich*
Spring 2023	**Quantum Information Processing I: Concepts**, *Teaching Assistant*	*ETH Zürich*
Fall 2022	**Physics Lab 1**, *Teaching Assistant*	*ETH Zürich*
Spring 2022	**Quantum Information Processing I: Concepts**, *Teaching Assistant*	*ETH Zürich*
Fall 2021	**Quantum Information Theory**, *Teaching Assistant*	*ETH Zürich*

Academic Services

Peer Review & Grant Contributions

- Contributed to the peer review of ∼20 manuscripts for journals such as *Phys. Rev. Lett.*, *Phys. Rev. X*, *PRX Quantum*, *Phys. Rev. A*, *Phys. Rev. Research*, *Npj Quantum Inf*.
- Contributed to five grant proposals including "*Implementations and Applications of Bosonic Codes"* (SNSF Project Funding) and "*Interacting error-correction codes in Penning trap arrays"* (SNSF Advanced Grant).

Community Engagement

Apr 2026	**Monte Verità Quantum Codes (MVQC)**, *Co-organizer* Organization in progress.
2024-2025	**Ion Trapping Online Seminar (ITOS)**, *Co-organizer*
Jun 2022	**Quantum Computing Hard- and Software summer school 2022**, *Lead organizer* Led the organization of the summer school, including program design, venue logistics, speaker invitations, budget management, outreach, and coordination with sponsors.
2020-2022	**Quantum Engineering Commission (QEC)**, *Board member* Organized the weekly journal club (Quantum Paper Club) for the association of students interested in quantum engineering.
2018-2019	**International Physicists' Tournament**, *Member of Swiss Team* Prepared and presented solutions to open-ended physics problems at an international BSc-level competition, ranking 5th among 20 teams.

Languages

Computer	Julia, Python, C++11, C, Bash, Ruby, HTML, CSS, MatLab,
Human	English (fluent), French (first), Russian (first), German (B2),

Publications

[1] M. Simoni, **IR**, M. Mazzanti, W. Adamczyk, A. Ferk, P. Hrmo, S. Jain, T. Sägesser, D. Kienzler, and J. Home, "*Non-linear cooling and control of a mechanical quantum harmonic oscillator*", arXiv:quant-ph/2509.05734 (2025).

[2] L. Fioroni, **IR**, and F. Reiter, "*Learning-agent-based approach to the characterization of open quantum systems*", Phys. Rev. Applied **24**, 034011 (2025).

[3] E. Zapusek, **IR**, and F. Reiter, "*Scaling Quantum Algorithms via Dissipation: Avoiding Barren Plateaus*", arXiv:quant-ph/2507.02043 (2025).

[4] **IR**, E. Zapusek, and F. Reiter, "*Scalable dissipative quantum error correction for discrete-variable codes*", arXiv:quant-ph/2507.12534 (2025).

[5] N. Kaufmann, **IR**, and F. Reiter, "*Characterization of coherent errors in gate layers with robustness to Pauli noise*", Phys. Rev. Appl. **23**, 034014 (2025).

[6] **IR**, P. M. Röggla, M. Wagener, M. Fontboté-Schmidt, S. Welte, J. Home, and F. Reiter, "*Two-Qubit Operations for Finite-Energy Gottesman-Kitaev-Preskill Encodings*", Phys. Rev. Lett. **133**, 100601 (2024).

[7] **IR**, M. Simoni, E. Zapusek, F. Reiter, and J. Home, "*Stabilization of cat-state manifolds using nonlinear reservoir engineering*", arXiv:quant-ph/2407.18087 (2024).

[8] A. Abivardi, C. W. Korn, **IR**, S. Gerster, R. Hurlemann, and D. R. Bach, "*Acceleration of inferred neural responses to oddball targets in an individual with bilateral amygdala lesion compared to healthy controls*", Sci. Rep. **13**, 14550 (2023).

[9] **IR**, D. Layden, P. Cappellaro, J. Home, and F. Reiter, "*Bias in Error-Corrected Quantum Sensing*", Phys. Rev. Lett. **128**, 140503 (2022).

[10] M. Malinowski, C. Zhang, V. Negnevitsky, **IR**, F. Reiter, T.-L. Nguyen, M. Stadler, D. Kienzler, K. K. Mehta, and J. P. Home, "*Generation of a Maximally Entangled State Using Collective Optical Pumping*", Phys. Rev. Lett. **128**, 080503 (2022).

Presentations

Invited Talks

Sep 2024 **AWS Center for Quantum Computing**, *California Institute of Technology (host: Connor Hann)*
"*Stabilization of cat-state manifolds using nonlinear reservoir engineering*"

Aug 2024 **Pritzker School of Molecular Engineering**, *University of Chicago (host: Liang Jiang)*
"*Stabilization of cat-state manifolds using nonlinear reservoir engineering*"

Aug 2024 **QuICS**, *University of Maryland (host: Victor V. Albert)*
"*Stabilization of cat-state manifolds using nonlinear reservoir engineering*"

Aug 2024 **Thompson Lab**, *Princeton University (host: Jeff Thompson)*
"*Stabilization of cat-state manifolds using nonlinear reservoir engineering*"

Aug 2024 **Yale Quantum Institute**, *Yale University (hosts: Steve Girvin & Shruti Puri)*
"*Stabilization of cat-state manifolds using nonlinear reservoir engineering*"

Aug 2024 **Lukin group - Quantum Optics Laboratory**, *Harvard University (host: Johannes Borregaard)*
"*Stabilization of cat-state manifolds using nonlinear reservoir engineering*"

Aug 2024 **iQuISE seminar**, *Massachusetts Institute of Technology (host: Paolla Cappellaro)*
"*Stabilization of cat-state manifolds using nonlinear reservoir engineering*"

Mar 2024 **Collège Sismondi**, *Highschools of Geneva (host: Julien Ponard)*
"*Quantum Computers with Trapped Ions*"

Feb 2024 **Quantum Paper Club**, *ETH Zürich (host: Quantum Engineering Commission)*
"*Multi-Qubit Gates for Bosonic Logical Qubits*"

Nov 2023 **Lunch seminar**, *ETH Zürich (host: Quantum Center)*
"*Stabilization of cat-state manifolds using nonlinear interactions*" (with M. Simoni)

Jan 2022 **Hammerer's group**, *Leibniz Universität Hannover (host: Klemens Hammerer)*
"*Bias in Error-Corrected Quantum Sensing*

Contributed presentations

** oral presentation; + poster presentation*

Mar 2025 **Global Physics Summit (March Meeting) 2025 ***, *Anaheim, USA*
"*Stabilization of cat-state manifolds using nonlinear reservoir engineering*"

Jan 2024 **Swiss Quantum Days +**, *Villars-sur-Ollon, CH*
"*Stabilization of cat-state manifolds using nonlinear interactions*"

Jun 2023 **Bolder Boulder Quantum Workshop (BBQ) +**, *Boulder, USA*
"*Dissipative stabilization of rotational symmetric codes*"

Jan 2023 **Coping with Errors in Scalable QC Systems (778. WE-Heraeus-Seminar) +**, *Bad Honnef, DE*

"*Characterization and mitigation of coherent errors of near-term quantum devices*"

Jul 2022 **Quantum Communication, Measurement and Computing (QCMC)** [+], *Lisbon, PT*
"*Bias in Error-Corrected Quantum Sensing*"

Jun 2022 **Quantum Computing Hard- and Software (QCHS)** [+], *Lausanne, CH*
"*Bias in Error-Corrected Quantum Sensing*"

Jun 2022 **QSIT - Quantum Science and Technology Junior meeting** *, *Flumserberg, CH*
"*Bias in Error-Corrected Quantum Sensing*"

Nov 2021 **European Quantum Technologies Conference (EQTC)** [+], *Online*
"*Bias in Error-Corrected Quantum Sensing*"

Jun 2021 **Quantum Computing Hard- and Software (QCHS)** [+], *Online*
"*Bias in Error-Corrected Quantum Sensing*"

May 2021 **Division of Atomic, Molecular and Optical Physics (DAMOP)** *, *Online*
"*Bias in Error-Corrected Quantum Sensing*"