Nicolas Dirnegger

Los Angeles, CA, USA | nickeyd01@ucla.edu | Nicolas Dirnegger | nicolas-dirnegger | Nickeyd01

Education

University of California, Los Angeles — *Sep 2022 - Expected June 2027*
PhD in Electrical and Computer Engineering
MS in Quantum Science and Technology, Physics

ETH Zurich — *Sept 2019 – Aug 2022*
BS in Electrical and Computer Engineering

Academic Experience

NarangLab — *Los Angeles, CA*
Graduate Student Researcher, Prof. Prineha Narang — *June 2023 – Present*

- Analysis of networked non-reciprocal quantum battery systems and control of qubit-qubit coupling of non-reciprocal superconducting elements.
- Developed a superconducting ring resonator model to investigate time-reversal symmetry breaking in unconventional superconductors, deriving Hamiltonian, Langevin Equations and bistability regions.
- Computational analysis of quantum networks methods for remote entanglement and routing schemes in graph states applying X-protocol on DODAG tree.

Mesoscopic Optics and Quantum Electronics Laboratory — *Los Angeles, CA*
Graduate Research Assistant, Prof. Chee-Wei Wong — *Sep 2022 – June 2023*

- Experimental measurements of on-chip integrated octave spanning frequency comb and soliton generation with dispersive waves. Device characterization and measurement of photonic ring resonators. Device design and experimental measurements of Q values, FSR and Cherenkov radiation. Post-processing of data in Matlab.
- Numerical simulations of dynamical decoupling sequences of superconducting qubits.

Institute of Electromagnetic Fields — *Zurich, Switzerland*
Undergraduate Research Assistant, Prof. Juerg Leuthold — *Sep 2021 – Aug 2022*

- Design of an efficient photonic grating couplers with sub-decibel coupling efficiency with FDTD and FME, work included in *ACS Photonics*, Link to Publication
- 2D and 3D designs and simulations of couplers for plasmonic devices using Lumerical, Comsol and Matlab.

Professional Experience

IBM Research-Quantum — *Yorktown Heights, NY*
Quantum Hardware Engineer Intern — *June 2024 – Sep 2024*

- Computational analysis of remote entanglement methods for superconducting qubits with transducer and entanglement distillation. Theoretical analysis, experimental implementation and high performance simulations using IBM CCC cluster.

Air Force Research Laboratory — *Rome, NY*
Quantum Co-Op Intern — *June 2023 – Sep 2023*

- Device theory, design and simulation of low frequency superconducting ring resonator with Matlab, Comsol and LTSpice. Design, composition and measurement of PCB resonator using surface mount and through hole components.
- Qubit characterization with single shot measurement. Measurement of qubit system under external laser drive to establish quasi-particle tunneling and resulting effects on T1, T2 and T2* time

ETH Zurich — *Zurich, Switzerland*
Teaching Assistant — *Feb 2022 – June 2022*

- Delivered tutorials and created hands-on lectures for an undergraduate course on electromagnetic fields and waves, increasing student understanding and engagement.

Publications and Talks

[1] **N. Dirnegger** et al., "Efficient Multiparty Entanglement Distribution in Quantum Networks", *SPIE Photonics West* (2025)

[2] R. Negrin, **N. Dirnegger** et al., "Efficient Multiparty Entanglement Distribution with DODAG-X Protocol", *arXiv preprint, arXiv:2408.07118, in review at Physical Review Applied* (2024)

[3] **N. Dirnegger**, J.Curtis et al., "Nonlinear Superconducting Resonators for Exploring Novel Quantum Materials", *APS March Meeting* (2024)

Skills & Projects

Coding Languages: Python, C++, Java, MATLAB, Mathematica

Languages: German, French, English, Spanish

Lab Experience:

- Design and simulation for microwave and optical devices in Comsol, Lumerical, LTSpice. Basics of GDS, HFSS & KLayout, Superconducting Qubit Measurement, Readout and Setup.
- Fiber and Free Space Optics, Laser Alignment, Frequency Comb Generation, LabView, RF Engineering, Simulink, PCB Design and Measurement, Soldering.

Software Experience:

- Lumerical, Comsol, LTSpice, Ansys, Qiskit, QuTip
- High Performance Computing.
- Typesetting LaTeX, HTML/CSS, and others.
- Qiskit Quantum Computing Labs covering Circuit Design, Measurement and major quantum algorithms. Design of QAOA in Qiskit to MAXCUT problem.

Science Fair *Vienna, Austria*
Winner 2018 Science and Technology Fair *May 2018*

- Developed a thermal energy conversion headset, achieving local recognition in Austrian media Read article: "Strom aus der Wärme von Kopfhörern"

Outreach

Quantum Computing Student Association - QCSA *Los Angeles, CA*
Board Member

- Organization of events that include academic and industrial speakers, Hackathons, Workshops, and collaborations with other local Los Angeles universities, LinkedIn.

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Aerospace Initiative ETHZ - ARIS *Zurich, Switzerland*
Hardware Engineer

- Part of the liquid rocket engine team as a hardware engineer on sensors, circuit design, and electrical wiring.
- Responsible for sensor data acquisition and analysis of data as well as circuit layout of the electronic system. Assembly of sensor and actuators needed to control and regulate temperature, pressure levels, fuel levels and vibrations in rocket.

GVI - Volunteer *Pokhara, Nepal*
Volunteer

- Volunteering abroad in Pokhara in Nepal to rebuild and renovate a local school. Social media fundraiser to support the local school system in the Pokhara region.