Max Drimmer - Graduate Student

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Personal Profile

Graduate student in physics with a strong experimental background focused on quantum mechanics. Has experience with optics, acoustics, microwave electronics, and nanofabrication and strong research interests in optomechanics, solid state quantum technologies, and photonics. Determined, self driven student capable of taking responsibility for projects, seeking out necessary resources, working well with a team, and clearly stating and understanding scientific objectives in a competitive research environment.

Education

2020- **Doctor of Philosophy, Physics** - Eidgenössische Technische Hochschule Zürich (ETH Zürich)

Advisor: Yiwen Chu

2018-2020 **Master of Science, Applied Physics** - Technische Universiteit Delft (TU Delft)

Master's Thesis: *Slap!* Developing Hybrid Acousto-Optic Systems for Wavelength Conversion (found here: www.repository.tudelft.nl/islandora/object/uuid:2f6778b1-a6e5-442c-b390-eb2a5f185d8e)
Advisor: Simon Gröblacher

GPA: 8.45

2014-2018 **Bachelor of Science, Physics** - Stanford University

Undergraduate Thesis: *Building a Nanophone:* Detecting Surface Acoustic Waves with an Optomechanical Cavity (found here: www.purl.stanford.edu/rn338fy1739)
Advisor: Amir Safavi-Naeini

GPA: 3.508

Experience

2019 - 2020 **Masters Researcher**
Gröblacher Lab

Wrote a Masters thesis about a new material platform for microwave-to-optical transduction. I investigated a technique termed 'slapping,' in order to fabricate novel hybrid devices. In this new technique, a loosely connected, suspended nanostructure is patterned on one chip such that a tapered fiber can be used to rip the structure away and place it in an arbitrary location on another device. I demonstrated this technique by placing silicon photonic crystal cavities patterned on a silicon nanobeam onto a lithium niobate thin-film electromechanical resonator. The goal was to combine the excellent optomechanical properties of the silicon nanobeam with large piezoelectric efficiency of the lithium niobate resonator in order to achieve efficient, coherent coupling between the microwave excitation and the optical cavity. Slapping allows for this hybrid silicon-lithium niobate device to be fabricated quickly and easily. I fabricated and characterized a device using this technique and measured the key figure-of-merit, microwave-to-optical transduction single-photon efficiency, to be within an order of magnitude of 'state-of-the-art.' This proof-of-concept was successful in illustrating a new route towards wavelength conversion, a key technological milestone necessary for future quantum networks. My work on this project included the experimental design, COMSOL simulations, nanofabrication, and conducting the simultaneous measurement of optical and microwave signals. This project was awarded a grade of '9.'

2016 - 2018 **Undergraduate Researcher**
Safavi-Naeini Lab

Wrote an undergraduate thesis on coupling surface acoustic waves in silicon to an optomechanical cavity at room temperature. We successfully measured acoustic waves (around 450 MHz), and determined that the devices were sufficiently sensitive for further research in nanoacoustics. For this project, I designed a way to generate acoustic waves on a silicon chip, preformed a heterodyne measurement to detect the signal from these waves using optomechanical cavity devices, did simulations to understand the dynamics of the system, and did some analysis to understand absorption in metallic thin films. This project was awarded a grade of 'A.' During the summer of 2017, I built custom PID-type systems that locked lasers to optical filters and modulators using a simple Raspberry Pi controller and designing analog circuits. During the summer of 2016, I helped design and test simple superconducting circuits on Lithium Niobate chips. In addition I helped to set up the cryogenic microwave electronics in a new dilution refrigerator; this included working with low-noise amplifiers, attenuators, bias-tees and building cables.

Technical Summary

Conducting Optical and Microwave Experiments

- Experienced with designing, setting up, and using telecom-band (1550 nm) fiber optical and microwave signals to characterize nanoscale photonic, acoustic, and mechanical devices.
- Comfortable using common experimental components such as tunable lasers, modulators, filters, network analyzers and detectors.

Nanofabrication

- More than one year of experience with nanofabrication techniques including electron beam lithography, wet and dry etching, thin-film metal and dielectric deposition, and inspection using an scanning electron microscope.
- Experienced working with Silicon-on-Insulator, and bulk and thin-film Lithium Niobate.

Preforming Simulations

- Has used FEM simulations (mainly in COMSOL) to design nanophotonic and nanomechanical devices by optimizing parameters like coupling rates between resonators and quality factors of cavities.
- Carried out 'band gap engineering' by designing photonic crystal cavities and mechanical resonators with phononic shields in COMSOL simulations.
- Additionally, some experience using Python and Mathematica to do numerical simulations.

Miscellaneous Engineering Skills

- Proficient with common cryogenic measurement techniques using both liquid helium and dilution refrigerator systems.
- Capable of building, using, and troubleshooting analog electronics as well as designing PCBs for simple circuits like optical switches and photodiodes.
- Experience working with high-vacuum systems.
- Has designed experimental components in SOLIDWORKS and worked in a machine shop to build them.

Awards and Skills

Awards

- 2018 QuTech Academy Scholar
- 2019 Casimir Research School Pre-PhD Honors Student

Skills

- Knows English as a native speaker and German at an intermediate (B2) level
- Experienced in coding in Python, MATLAB, Mathematica and comfortable completing programming tasks

Conferences

- Attended PHOTONICA2019 at Belgrade, Serbia in August 2019
- Attended Physics@Veldhoven at Veldhoven, Netherlands in January 2020

References

Name	Simon Gröblacher	**Name**	Amir Safavi-Naeini
University	Technische Universeiteit Delft	**University**	Stanford University
Department	Applied Sciences - Quantum Nanoscience	**Department**	Applied Physics
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