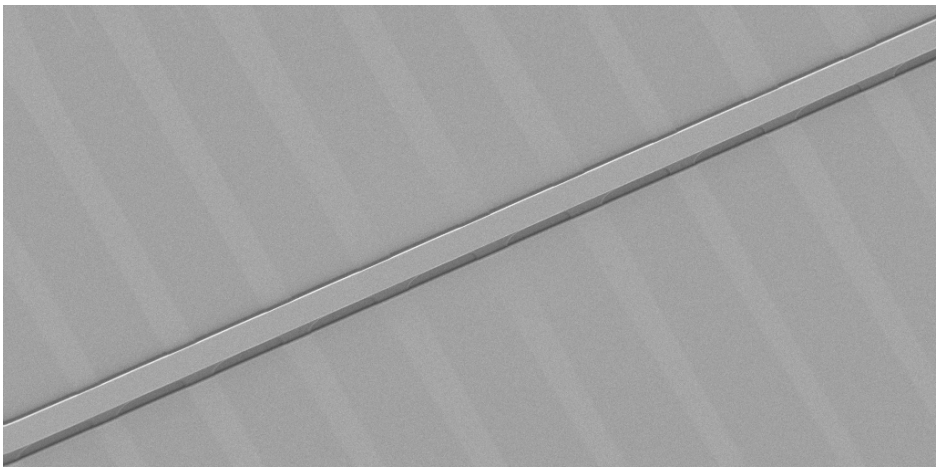
Dispersion engineering for nonlinear integrated quantum photonics

As a non centrosymmetric crystal lithium niobate (LN) supports nonlinear 3-Wave-mixing processes due to its $\chi^{(2)}$ nonlinearity. One of those processes is Spontaneous parametric down conversion (SPDC). SPDC can be used to downconverter a pump photon of a certain wavelength into two entangled photons with approximately double the wavelength, which can be used for a broad range of quantum information applications. To enhance the efficiency of this process one needs to periodically switch the crystal orientation of LN, this can be done by applying strong electric field pulses.



SEM image of a periodically poled lithium niobate waveguide. The different colors indicate different orientations of the crystal axis.

In this project we aim to develop a workflow of using periodically poled lithium niobate (PPLN) for quantum technological applications. This comes with a few challenges, like properly simulating the optical and nonlinear properties of a PPLN waveguide, refining the fabrication workflow of PPLN, and accurately measuring the characteristics of the fabricated devices.

A student working on this project will work on:

- the simulations of optical properties of integrated PPLN devices.
- Periodic poling of Lithium Niobate
- Imaging of the fabricated devices
- Measuring the PPLN devices in an optical lab.

If you are interested in this area of research and would like to join our team for a Bachelor, Semester, or Master's project, or if you have any further questions, feel free to reach out to us.

Interested students, please contact: rchapman@phys.ethz.ch