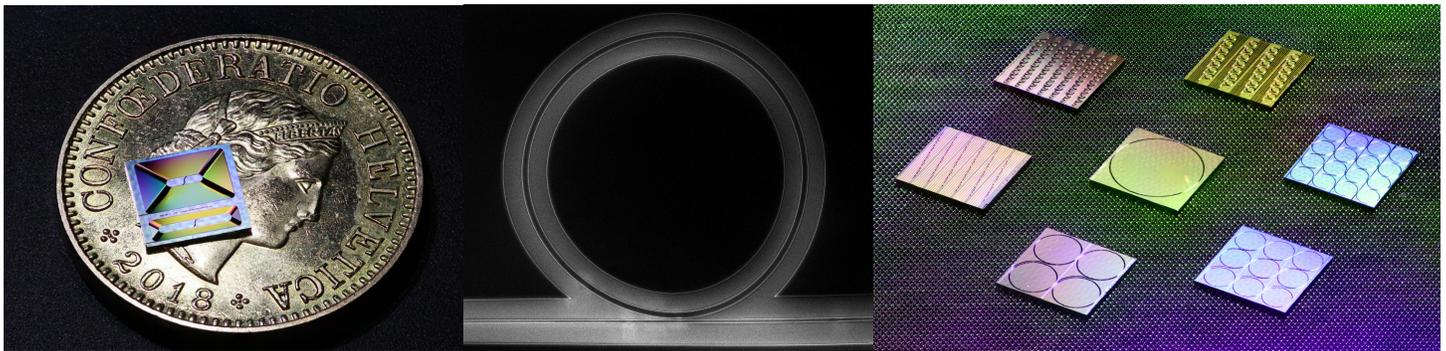




Master Thesis Scholarships and master projects on nanophotonics at the Swiss Federal Institute of Technology Lausanne (EPFL)

The **Laboratory of Photonics and Quantum Measurements** (k-lab.epfl.ch) at the Swiss Federal Institute of Technology Lausanne (Ecole Polytechnique Fédérale de Lausanne, EPFL) offers scholarships for master's projects and theses for up to twelve months. The master thesis can be joint with a home institution in Europe. One of the main research directions in our group at EPFL is focused on novel applications of nonlinear photonic integrated circuits (PICs) based ultra-high-Q optical microresonators and optical frequency comb generation.



The group is exploring new materials, beyond the traditionally established Si₃N₄ platform, as well as new fabrication techniques to achieve unprecedented low loss and active control of photonic elements via heterogeneous integration. We have also demonstrated for the first time on-chip amplification at telecommunication wavelength, by using erbium-doped Si₃N₄ waveguides.

To strengthen our nanofabrication and photonics design team and to further develop our capabilities, we are looking for Master students for the following projects:

- Master project on 'Er-doped aluminum oxide development'

Aluminum oxide can be deposited as a high-quality insulating ceramic with a wide bandgap, enabling applications from the UV to telecommunication wavelengths. When doped with erbium, it can provide an active gain element for waveguide-based amplifiers and lasers. This project focuses on developing an Er-doped aluminum oxide platform, building on our group's expertise in Er:Si₃N₄ photonics [**Science 376, 1309-1313 (2022)**, **Nat. Photon. 18, 820-835 (2024)**].

- Master project on 'Developing low temperature hydrogen-free thin films, using ICP-CVD'

H-impurities in photonic waveguides cause strong OH absorption in the telecommunications band and typically originate from SiH₄-based precursors. Eliminating hydrogen normally requires high-temperature annealing, limiting compatibility with emerging platforms such as LiNbO₃ and LiTaO₃. Using a recently acquired ICP-PECVD system, this project develops low-temperature deposition processes based on the hydrogen-free precursor SiCl₄ to realize low-loss, hydrogen-free thin films [**arXiv:2312.07203**].

- Semester project on 'Developing oxide etching recipe on the TEL and SPTS Synapse'

Oxide etching underpins our ultra-low-loss photonic waveguides and long-standing work published in leading journals. This project focuses on developing and optimizing oxide plasma etching recipes on the TEL and the newly acquired SPTS Synapse system to further reduce propagation losses and expand photonic performance.

- Semester project on 'Developing backside nitride etching recipe on the SPTS Synapse'

This project focuses on developing a backside silicon nitride plasma etching process on the SPTS Synapse to enable controlled etchback for high-yield and crack-free damascene photonic device fabrication.

Being one of the two Swiss Federal Institutes, EPFL is known for its high international reputation and outstanding equipment. Access to unique 1500 square meter cleanroom facilities for nano-



fabrication is available <http://cmi.epfl.ch/in> for the master thesis project. EPFL campus in Lausanne is only at a few steps from Lake Geneva (see photo). As a major city in the French-speaking part of Switzerland, surrounded by Montreux and Geneva and the nearby Alps, Lausanne provides an attractive environment.



This scholarship addresses physicists or students of neighboring subjects (e.g. electrical engineering, material science, chemistry) interested in doing cutting-edge research on one of the aforementioned exciting and challenging projects.

A major asset of EPFL is its extensive cleanroom environment that is used for a number of advanced micro- and nanofabrication projects. Master students can gain access to the premier facility.

In your application, please clearly state that you are applying for a **Nanofabrication** master's thesis or semester project, and explicitly indicate your topic(s) of interest.



A monthly scholarship of 1,600 CHF is available for non-EPFL students to support a self-financed stay in Lausanne.

Literature:

1. Del'Haye, Schliesser, Arcizet, Wilken, Holzwarth & Kippenberg. "Optical frequency comb generation from a monolithic microresonator" *Nature* **450**, 1214 (2007).
2. Kippenberg, Holzwarth & Diddams "Microresonator Based Frequency Combs" *Science* **322**, 555 (2011)
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