

Lab project M2 PPN

Monday & Tuesday from Oct 2025 to March 2026

Title of the project: Broadband heterodyne interferometry

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Laboratory / Department / Team : Photonics/PRISM

Collaborations:

Summary:

As part of the research conducted at ICB on the development of new nonlinear materials for emerging photonic technologies such as miniaturized neuromorphic hardware, quantum optical computers, or environmental sensors, we are developing experimental methods for the metrology of light induced nonlinearities. Our main approach is based on generalized nonlinear heterodyne interferometry ([Rogemont et al, 2025](#)) invented recently in the lab.

The objective of this lab project is to leverage the knowledge and expertise acquired in the laboratory to design, assemble, and test a new interferometer architecture operating over an extended spectral band from visible to mid-infrared light for various user cases.

Unlike the previously developed interferometer, which relies on fiber optic components whose operation is limited to the telecommunications wavelength, the interferometer to develop in the lab project is a free-space version that will enable operation over an extended spectral band. Such an architecture, which also has the advantage to suppress the phase noise inherent in optical fibers, will require to develop a frequency modulation approach based on a pseudo-heterodyne detection scheme ([Ocelic et al, 2006](#)).

During the lab project which may continue in the second semester as an internship, the developed system will be tested on different spectral bands using the laser resources available in the laboratory (from 400 nm to 10 μ m) in order to determine the spectral variations of the nonlinear indices of typical waveguides (silicon-on-insulator and silicon nitride photonic integrated circuits, chalcogenide fibers).

Type of project (theory / experiment): Experimental

Required skills: Free space optics, nonlinear dynamics, signal processing