Master 2 "Systèmes Complexes, Optique, Lasers (SCOL)": Research Training 2022-2023
Master 2 "Matter Molecules and their Environment(MME)": Research Training 2022-2023

Appel à sujet de stage recherche / Call for research training subject

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Collaborator(s): Last name First Name

Topic: Optique guidée

Master 2: select the master and the most appropriate option

X□ Master 2 SCOL	□ Master 2 MME (GP-SCP)
□ Option Complex Systems (GP-IKS)	□ Option Condensed Matter
	□ Option Condensed Matter/Pharma
	□ Option Dilute Matter and Spectroscopy
	□ Option Atmospheric Sciences
	□ Option Modeling at the molecular & atomic scales

Title Power transfer matrix of a multi-plane light converter

Abstract (no more than 2000 characters)
Fiber optic telecommunications networks are composed of single-mode fibers (SMF) capable of guiding one single eigenmode. These networks – which are veritable success stories of modern technology – are capable of transporting enormous flows of data. The "capacity" of a SMF ie the number of bits it can transport per second has been pushed ever upwards by improvements in SMF on one hand and major breakthroughs in opto-electronics on the other. However in recent years the evolution of the capacity of a SMF has practically stagnated as it is approaching the physical upper limit of capacity.
Few-mode fibers (FMFs) guiding about 10 eigenmodes have a potential capacity 10 times higher, due simply to the multiplicity of modes. However in order to make use of this potential in a network one must have the capability to "transfer" an optical signal carried by a SMF to a specific eigenmode of a FMF. The optical component which performs this operation is called a "modal multiplexer" (MUX). The MUX that we will examine in this internship is based on the physical principle of multi-plane light conversion. It has 10 input ports (10 SMF) and one output port (1 FMF guiding 10 eigenmodes). The most important property of the MUX is its cross-talk. A MUX with zero cross-talk assures that all the power arriving on SMF number *i* gets transferred to eigenmode number *i* of the FMF. If the cross-talk is non-zero a part of the power from SMF number *i* is also transferred to the other eigenmodes of the FMF. This cross-talk can be quantified by the "power transfer matrix" of the MUX. It is however difficult to measure, it can not be measured by "standard" methods developped for photonic components based on SMF.
In this internship we are going to measure the power transfer matrix of a MUX using a time domain measurement. The intern will construct a simple optical setup comprising a pulsed source, MUX, FMF, detector, and oscilloscope; plan and execute the measurement campaign; and trean the data.

Key words: (no more than 1 line) Eigenmode; Multi-mode optical fiber; Measurement; Transfer matrix; Photonics.