POLARISATION MANAGEMENT IN CHIRAL PHOTONIC INTEGRATED CIRCUITS.

LABORATORY : Institut Lumière Matière
IN COOPERATION WITH : iLM

LEVEL : M1 / M2 / L3
TEAM(S) : MNP

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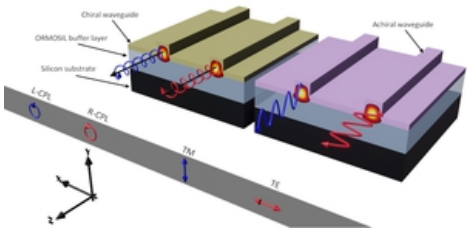
KEYWORD(S) : photonics / polarization / chirality

SCIENTIFIC CONTEXT :

Circular polarization is the key information vector for all the mechanism involing light and chiral objects such as chiral molecules or spin-selective quantum emitters. It is also the polarization used for 3D projection systems and it allows to limit the optical interference related to scattering media.



Polarization properties of chirowaveguides (left) and stabdard achiral waveguide

On standard optical integrated circuits only linear polarizations (TE and TM modes) can be used because of the planar symmetry of the optical chips. Thus, all applications requiring circular polarization of light are not benefiting from the advantages inherent to integrated optics. However, we are developing at the ILM in collaboration with ENS Lyon a new type of optical circuit with circularly polarized eigenmodes. Until now, only straight guides have been demonstrated but all the functions required for manipulating and routing this special polarization are missing.

The objective of this internship is to develop these optical functions: emitters, mode couplers, Y junctions, Mach-Zender, spirals... This will allow the creation of integrated optical circuits managing circular polarization. Thus, fields requiring circular polarization will be able to benefit from optical integration in terms of robustness, compactness, parallelization of measurements and low cost. We think, for example, of the control of biologically active chiral molecules on an optical chip, of the routing of single photon from quantum box spin states or of the imaging in scattering media.

MISSIONS :

The aim is to develop optical functions on chiroptical chips. According to his aspirations, the student will be involved in one or more of the following steps: (i) design (via simulations), (ii) realization (laser photolithography, transfer on PDMS and stamping) and (iii) optical characterization with a particular emphasis on the conservation of circular polarization and comparaison with theoretical prediction. In order of priority, and depending on the work already reallized in the team, the systems to be realized will be: emitters, spirals, splitters, adiabatics mode adapters, Mach-Zenders interferometers, gratting couplers.

OUTLOOKS :

PhD possible. Fund: Ecole doctorale

BIBLIOGRAPHY :

Stéphan Guy et al, "*Full polarization control of optical planar waveguides with chiral material.*", ACS Photonics **2017**

Hoshan Sahib et al "*Rib channel chirowaveguides: A simple way to free the integrated photonics from linear polarizations monopoly*", submitted to Advanced Photonics Material, **2021**

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