

CHIRAL INTEGRATED LASERS

LABORATORY : Institut Lumière Matière
IN COOPERATION WITH : iLM

LEVEL : M1 / M2
TEAM(S) : MNP

CONTACT(S) : GUY Stephan

CONTACT(S) DETAILS: stephan.guy[at]univ-lyon1.fr / Tel. 0472448330

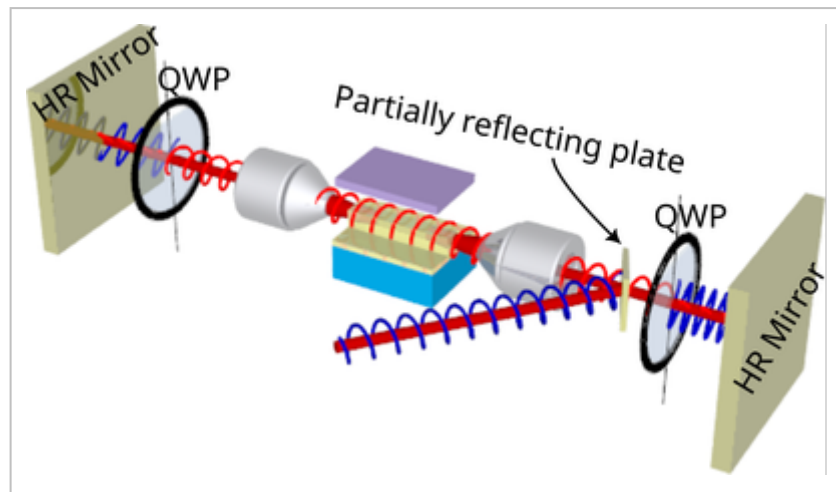
KEYWORD(S) :

SCIENTIFIC CONTEXT :

Circular polarization is the key information vector for all the mechanism involving light and chiral objects such as spin-selective quantum emitters or chiral molecules, which is crucial in various fields.

It is also the polarization used for 3D projection systems and it allows to limit the optical interference related to scattering media allowing for better imaging in natural environments. 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. **The aim of this internship is to bring circularly polarized light into integrated optics by developing a new kind of chiral laser.** This project is supported by the ANR 2024 iCPLaser. Our strategy is based on the doping of our chirowaveguides with specially designed Nd³⁺ rare earth chiral complexes to produce a new chiral gain medium. Chirowaveguides are a new type of optical waveguide, we are developing at the ILM in collaboration with ENS Lyon [Sahib2022]. They are the only optical waveguides bearing eigenmodes of propagation with the required circular polarization (CP) for the development of chiral laser.



MISSIONS :

Recent works have demonstrated very efficient amplifiers with photonic chips doped with these complexes and simple top pumping schemes. On our side, we work on chiral rare-earth complexes which combine high absorption, efficient energy transfer to the rare earth together with the so call CPL for Circularly Polarized Luminescence.

The aim is to develop the chiral laser. According to his aspirations, the student will be involved in one or more of the following steps: (i) design (via simulations), (ii) spectroscopic characterization of the chiral medium, (iii) design of the pumping scheme and gain measurement and (iv) realization of the laser cavity.

OUTLOOKS :

A continuation in thesis is possible for a motivated student.

BIBLIOGRAPHY :

Circularly polarized luminescence activity in the near infrared spectral region of a water-soluble ytterbium(iii) complex containing a conjugated chromophoric ligand *New Journal of Chemistry, Royal Society of Chemistry (RSC)*, **2024**, 48, 9627-96

Elliptical Birefringent Rib-Channel Chirrowaveguides for Quasicircularly Polarized Light Applications in Integrated Photonics *Adv. Photonics Res.*, **2022**, 3, 2100302