M2 Internship (4 to 6 months)

Laboratory: **Centre for Nanoscience and Nanotechnology**
Address: **University Paris Saclay, CNRS**
10 Boulevard Thomas Gobert, 91120 Palaiseau - France

Contact: Beatrice Dagens, Navy Yam, Stefano Pirotta

email: Beatrice.dagens@c2n.upsaclay.fr ; vy.yam@c2n.upsaclay.fr: Stefano.pirotta@c2n.upsaclay.fr

Website: https://cimphonie.c2n.universite-paris-saclay.fr/en/

SNOM development for guided wave near-field characterization

A particularly promising isolator[1,2] structure has been proposed and numerically demonstrated in Cimphonie Team (C2N) in 2021[3]. The principle, called magneto-biplasmonic, explores the Transverse Magneto-Optical Kerr effect (TMOKE) enhanced by both the surface plasmon polaritons and coupled modes system in a slot waveguide loaded by a magneto-optical (MO) material (see Fig. 1, from S. Abadian PhD manuscript, 2021). Here TMOKE induces asymmetrization of the coupled modes profiles, which depends on the propagation direction: the optical energy carried by these modes doesn't follow the same path in the forward and backward directions. This property is used to realize non-reciprocal optical transmission.

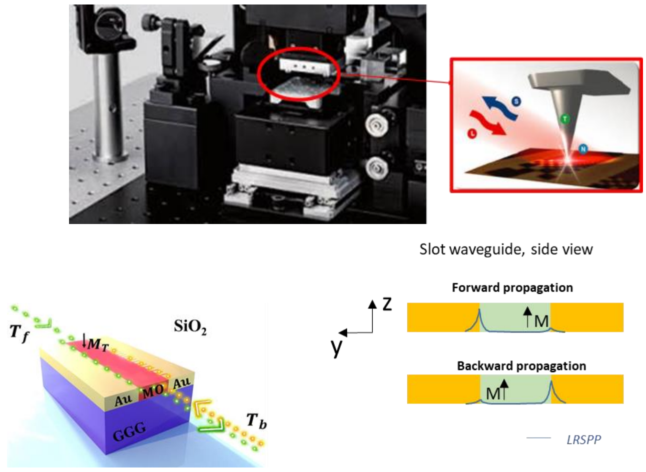

Fig. 1. Scheme of the SNOM setup (top), scheme of the magneto-biplasmonic isolator[3] (bottom, left), and basic operation principle illustrated with side and top views (bottom, right). BIG represents the MO material, with magnetisation M_T. L(S)RSPP=Long (Short) Range Surface Plasmon Polariton.

Internship

We propose a **four to six months** M2 internship, which can be followed by a PhD (involved in the **European project CIRCULIGHT**).

The main objective in the long term is to experimentally demonstrate the magneto-biplasmonic effect, using and adapting a Scanning-Near-Field Microscope (SNOM). A commercial SNOM is available in the host team, and the setup will be further developed in order to characterize MO and plasmonic guided devices.

The **internship topic** will include:

- bibliography report on SNOM (Scanning Near-field Optical Microscope) characterization for plasmonics

- characterization of plasmonic devices (already available) on SNOM apparatus, at 1.55µm: design and realization of fiber injection system compatible with SNOM.

VALUED QUALITIES IN THE STUDENT

- Curiosity for novel research experiences and fields.
- Ability to work in a multipartner project, in english
- Creativity and pro-activity in the search for innovative solutions and approaches.
- Attractivity in experiments and simulations.
- Capability to communicate and share results in a multidisciplinary and multi-nationality environment.

1. D. Jalas, A. Petrov, M. Eich, W. Freude, S. Fan, Z. Yu, R. Baets, M. Popović, A. Melloni, J. D. Joannopoulos, M. Vanwolleghem, C. R. Doerr, and H. Renner, "What is-and what is not-an optical isolator," Nature Photonics 7, 579–582 (2013).

2. B. J. H. Stadler and T. Mizumoto, "Integrated magneto-optical materials and isolators: A review," IEEE Photonics Journal 6, (2014).

3. Sevag Abadian, Giovanni Magno, Vy Yam, and Beatrice Dagens, "Broad-band plasmonic isolator compatible with low-gyrotropy magneto-optical material," Opt. Express 29(3), 4091-4104 (2021). https://doi.org/10.1364/OE.415969