Postdoctoral position in **photonic circuit design, fabrication and characterization**

for ULTRAfast nonthermal MAGnetization switching

(20 to 24 months)

(Starting in January 2025)

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ULTRAfast nonthermal MAGnetization switching : from fundamental to application

Context : switching the magnetization at the fastest speed and with the lowest energy is one of the hottest topics in modern magnetism. The ULTRAMAG project (ANR) aims to explore the optical magnetization switching in photoactive transparent magnets using femtosecond laser pulses. We plan to investigate this phenomenon in a variety of novel iron garnet systems very suitable for nonthermal laser-induced magnetization switching, including the effects of several fundamental parameters like the magnetic anisotropy, the thickness of the film, the size and shape of micro and garnet nanostructures on the switching speed and energy efficiency. The optimized system will be coupled to a silicon-based photonic layer, as shown in Fig. 1, to realize an integrated photonic-magnetic platform for future ultrafast nonthermal data storage and processing technology.

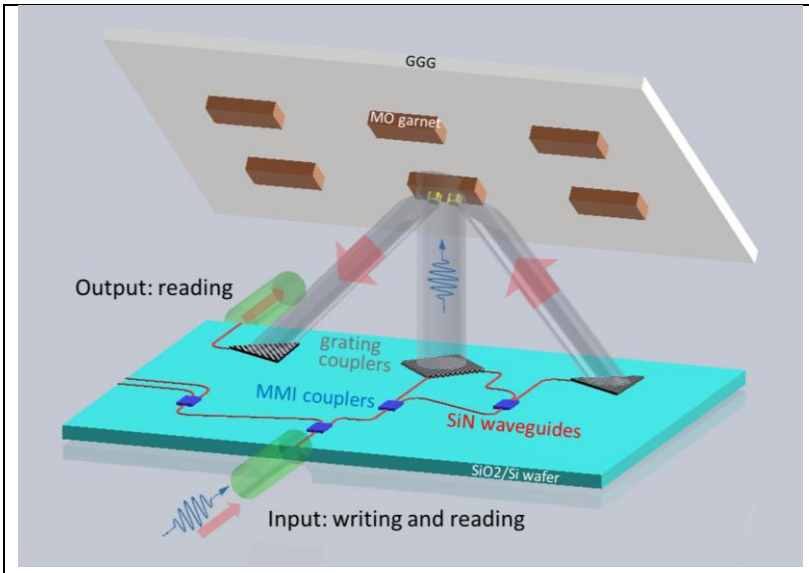

Fig. 1. Schematic view of the coupled photonic and magnetic platforms. The photonic layer contains a read and write circuit that shares the same input. The write circuit has a grating coupler including two input ports, which allows controlling the polarization of the writing laser pulses. The read circuit has a grating that allows to direct the probe at an angle to the magnetic structure, in order to enable the reading of the magnetic state.

Tasks of the postdoctoral fellow: the postdoctoral fellow will be first in charge of the design of the SiN photonic circuit integrated on SiO2/Si, including gratings couplers enabling either ultrafast laser pulses propagation and emission (central coupler in Fig. 1), or continuous wave directive and polarization independent emission (side couplers in Fig. 1), possibly inspired from [1]. Then he/she will be involved in technological fabrication: micro/nanostructuration of the MO garnet, and photonic circuit realization. Finally he/she will perform the continuous wave characterization of the photonic circuit.

The postdoctoral fellow will be part of the ANR project ULTRAMAG consortium: he will participate to the project meetings and contribute to project results communications and publications.

Profile required

- Education in optics/photonics
- Scientific skills
    - o Knowledge of nanofabrication in clean room (for process monitoring).
    - o Good knowledge of optical characterisation
    - o Basic knowledge of optical simulation (FDTD)
- Transversal skills
    - o Ability to analyse, solve technical problems and work in a team
    - o Good interpersonal skills and autonomy
    - o Good level of written and spoken English; French knowledge appreciated.

[1] H. Becker et al., IEEE Journal of Selected Topics in Quantum Electronics 26, 1 (2020).

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