INTERNSHIP PROGRAM FOR INTERNATIONAL STUDENTS

INTERNSHIP SUBJECT FORM

Name of the Host Laboratory	LSI Ecole Polytechnique
Website of the Host Laboratory	https://portail.polytechnique.edu/lsi/fr
Research Group	“Physics and Chemistry of Nanoobjects” and “New Electronic States”
Internship Supervisor	Vasily Temnov and Yannis Laplace
Internship Subject	Nondestructive femtosecond laser lithography of ferromagnetic thin films
Student’s level	X Advanced Undergraduate Students (3rd or 4th year) X Master’s students (1st or 2nd year) X PhD students
Proposed Duration	☐ 3 months ☐ 4 months ☐ 5 months X 6 months
Prerequisites	
Internship description (max. 15 lines)	*Nowadays it is very easy to drill a “hole” by focusing high-power laser radiation on a thin foil of an optically absorbing material. It is way less obvious to create more sophisticated nanostructures with desired geometry and novel physical properties [1], which can originate from the interplay of magnetic, plasmonic and acoustic functionalities [2]. The main goal of this internship is to advance the new nanofabrication technique of nondestructive lithography in metallic thin films by single ultrashort (femtosecond) laser pulses [3] creating emply cavities (bubbles) formed by a free-standing magnetic membranes. The objectives of this internship are to produce such novel metallic nanostructures experimentally by (Labview-controlled) sample scanning through an optical focus. Arbitrary spatial distributions of laser intensity in focus will be used to produce complex (chiral, topological etc.) nanopatterns. Alternatively, theoretical description and (MATLAB-based) numerical simulations of the optical, acoustic and magnetic properties of laser-produced nanostructures can be done. As an example, ultrafast magneto-elastic phonon-magnon interactions can be applied to the resonant case of a free-standing magnetic membrane with the goal to excite large amplitude nonlinear magnetization precession towards ultrafast non-thermal magnetization switching [4].* References:

	[1] A.Y. Vorobyev and C. Guo, Laser & Photonic Reviews 7, 385 (2013) [2] V. Temnov, Nature Photonics 4, 107 (2012) [2] V. Temnov et al., Nanoletters 20, 7912 (2020) [4] V. Besse et al., J. Mag. Magn. Mat. 502, 166320 (2020); V. Vlasov et al., Phys. Rev. B 101, 024425 (2020) *Email:* *vasily.temnov@polytechnique.edu* *or* *yannis.laplace@polytechnique.edu*

The boxes marked with cross implies eligible