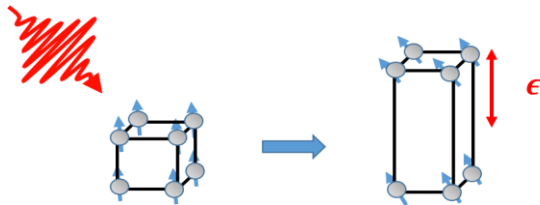


PhD position (starting in September 2026)

Ultrafast control of spin dynamics via phonons in ultrathin insulating magnets.

Context:

The energy consumption due to the “digital world” is projected to account for 20% of the global electricity consumption by 2030 [1]. This trend highlights the urgent need for more energy-efficient approaches to information processing and computation. One promising and already well-established alternative is based on the spin degree of freedom [2]. Collective spin excitations, known as spin waves, enable the transport and processing of information with minimal Joule heating. In addition, the magnetization direction can encode information in a non-volatile manner. Consequently, developing efficient methods to control magnetization and to generate fast, long-lived spin dynamics is a key challenge for next-generation technologies.



Effect of the optically induced strain in a magnetic system. The thermal expansion ϵ modifies the spin system through magneto-elastic coupling

Garnets are magnetic insulators with extremely low magnetic losses even at the nanoscale, making them highly attractive for spintronic applications [3,4]. They remain one of the key materials to develop spin wave-based devices for data processing or transport [5,6]. In this material, femtosecond laser pulses offer unique opportunities to manipulate spin systems on ultrafast timescales [7]. Recent work has demonstrated that, in nanometer-thick garnet films, laser-induced strain can influence spin

dynamics via magneto-elastic coupling, notably by modifying the precession frequency [8]. Additionally, strain pulses generated through the optical excitation of a metallic transducer have shown the possibility to induce high frequency spin precession in these thin films [6,9,10].

Tasks:

Building on these results, the PhD project aims to exploit optically generated strain to:

- (i) Modify the direction of magnetization in garnet thin film highly sensitive to strain.
- (ii) Induce high frequency spin wave mode in multilayer garnet heterostructures.
- (iii) Use optimized metallic transducer to generate strain wave of high amplitude and push the frequency of excited spin wave to the THz frequency range.

The PhD candidate will be responsible for developing an advanced all-optical pump–probe experimental setup to investigate ultrafast optical control of spin dynamics.

This research will open new perspectives for the efficient generation, propagation, and control of spin excitations in thin-film materials, useful for future low-power spintronic and nanodevice technologies.

Skills:

We are looking for a candidate strongly motivated for experimental work with a strong background in condensed matter physics and more specifically within the field of magnetism. Good knowledge of English is required. Previous experience in optical pump probe set up and/or magnetism is a plus.

Experimental environment and supervision:

The PhD candidate will benefit from the internationally recognized expertise of the PUMMA team in the fields of light–matter interaction and femtomagnetism. The PhD experimental work will be based on ultrafast optical spectroscopy techniques within the '[femtosecond laser platform](#)' of the IMMM, which gathers state-of-the-art femtosecond laser equipment.

Supervision : Dr. L. Soumah (CR CNRS, Le Mans University), Dr. V. Juvé (CR CNRS, Le Mans University), Prof. P. Ruello (Le Mans University) contact : Lucile.Soumah@univ-lemans.fr

Further details and application:

Please contact lucile.soumah@univ-lemans.fr and vincent.juve@univ-lemans.fr for more details about the project or visit the [PUMMA](#) website for more details on the experimental platform.

To **apply before the 11th of May** please send CV and cover letter to lucile.soumah@univ-lemans.fr and vincent.juve@univ-lemans.fr.

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