NV-center microscopy of spin wave beams

Marie Skłodowska-Curie COFUND SEED program - INDUSTRIAL TRACK

A key contender for future energy-efficient computing and signal processing devices is based on the manipulation of magnons or spin-waves, which are the elementary excitations of magnetic materials. Magnons can be manipulated on a broad range of the microwave spectrum at both room and low temperatures, and are therefore of interest for 5G/6G applications [1]. Besides, a wide variety of non-reciprocal effects inherent to spin dynamics offers promising opportunities for the miniaturization of analog signal processing components such as microwave isolators, circulator and directional couplers [2]. Furthermore, new functionalities are emerging from non-boolean and wave-based computing concepts, where both amplitude and phase of spin waves are considered as new degrees of freedom for encoding the information [3]. For all these reasons, spin-wave devices are now recognized as a credible beyond-CMOS technology.

The ability to visualize and manipulate coherent spin-wave transport is crucial for the development of magnonic devices. Recent studies demonstrated the possibility to image magnetization dynamics via NV magnetometry with unprecedented sensitivity and spatial resolution [5, 6]. However, research on spatially resolved spin-waves is at a very early stage, and constitutes mostly proof-of-concept measurement obtained on a home-built system at comparably low frequencies (i.e. below 3GHz). The purpose of this project is to construct an integrated probing scheme for QZabre commercialized NV center microscope (https://qzabre.com/en) that simplifies the access for non-expert users, and with the capacity to image magnetization dynamics at the nanoscale on a broad frequency and applied field range.

The PhD student will be working in close collaboration between IMT Atlantique and Qzabre, led respectively by Dr. Vincent Vlaminck, who brings a long-term experience in spin-wave spectroscopy, and Dr. Andrea Morales, who is a pioneer in commercialization of scanning NV magnetometry. This partnership combines two expert-level complementary skillsets to lead the development of a new measurement scheme.

The position is open until filled with a starting date as early as October 2024. More info about the competitive allowance package of the SEED program can be found in the following link:
https://www.imt-atlantique.fr/en/research-innovation/phd/seed/enrolment

Applicants should send now their resume to either vincent.vlaminck@imt-atlantique.fr or andrea@qzabre.com.

References

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