Exploring ultrafast magnetization dynamics of 2D transition metal phosphorus trichalcogenides

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Keywords: ultrafast spin dynamics, nanostructured ferromagnets, 2D magnets

With most recent transistors reaching down 5 nm in thickness, new questions are raised on how to achieve viable THz magnetic control on heterostructures thick of a few atoms only such as 2D Van der Waals magnets. In this framework, the optical control of spin dynamics on the femtosecond time scale could represent a major improvement of the speed of data processing technologies [1]. The proposed experimental thesis work aims at addressing some of these research fields by following two key approaches. Firstly, the project will be dedicated to the understanding of spin and charges dynamics of transition metal phosphorus trichalcogenides (XPS_3 with X=Fe, Ni, ...). An example of such dynamics measurement in a Van der Walls multilayered magnet FePS2 sample at low temperature in the visible range is shown on figure 1.

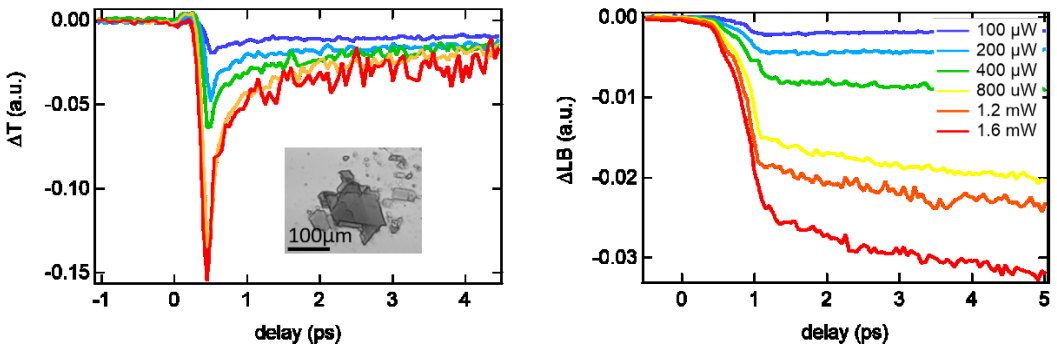

FIG 1: Pump probe measurements (resp at 400 nm and 800 nm) in a 200 layers $FePS_3$ at 30 K vs pump fluence. Left: transient transmission. Inset: 200 layers thick $FePS_3$ flake. Right: transient linear birefringence corresponding to spin dynamics (LB).

The emphasis will then be made on understanding the interplay of the electrons, spins and phonons ultrafast dynamics inside and between each constituent, depending on nanostructure geometry and composition and type pf substrate (isolant, metallic or magnetic substrate). The successful candidate will actively participate in the team's activities and acquire high- level skills in ultrafast spectroscopy and magnetism within a friendly and supportive work environment. They will have access to the forefront ultrafast magneto-optical techniques developed by our team over the past few years, spanning from the visible to XUV ranges [3-4]. We are looking for a highly motivated candidate with a strong background in condensed matter physics and light-matter interaction processes, and a keen interest in experimental physics.

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