

Photothermal Switching of Magnetization Textures in FeSn: Electron Microscopy and Simulations

Michalis Charilaou

Department of Physics, University of Louisiana at Lafayette

Wednesday, Dec. 3rd @ 2:00 pm in BRK 1001

Coffee and snacks served before seminar

also on [MS Teams](#)

Abstract: The ability to control internal magnetic fields in materials with light opens exciting new avenues in data storage, spintronics, and quantum computing. Localized magnetization textures like domain walls, vortices, and skyrmions, whirls of the local magnetization vector, are particularly promising candidates for new technologies due to their small size and inherent topological stability. Achieving control over magnetic states without applying large magnetic fields or currents could significantly enhance their practical applications. In this talk, I will discuss recent experiments and simulations [1] that demonstrate how femtosecond laser pulses can switch nanoscopic magnetization textures in the Kagome magnet Fe₃Sn₂ at room temperature and without the need for external magnetic fields. Using in situ Lorentz transmission electron microscopy, we have observed stochastic ultrafast modification of the magnetization. Micromagnetic simulations reveal the underlying nanoscale rearrangements induced by single femtosecond pulses, providing valuable insight into the dynamics of photothermally driven magnetization control. These observations are promising for the development of energy-efficient, high-speed magnetic devices for new information storage and processing technologies.

[1] J. T. Weber, A. Kovács, M. Charilaou, D. Kong, L. Prodan, V. Tsurkan, A. Schröder, N. S. Kiselev, I. Kézsmárki, R. E. Dunin-Borkowski, A. H. Tavabi, S. Schäfer: *All-optical stochastic switching of magnetization textures in Fe₃Sn₂*. Communications Materials 6, 223 (2025).

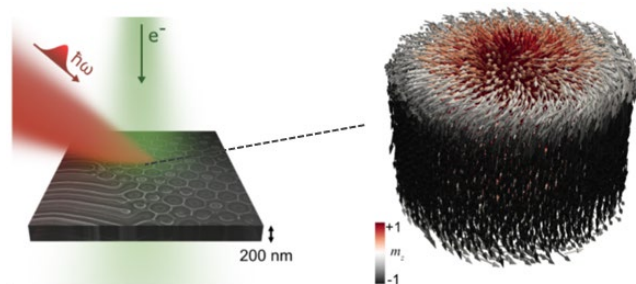


Figure 1: in-situ electron microscopy of FeSn while exposing the system to ultrafast laser pulses. The laser pulse induces modifications in the internal structure of dipolar skyrmions.

Bio: Michalis is an associate professor of physics at the University of Louisiana at Lafayette. He studies magnetization dynamics of nanoparticles and nanostructures using computational methods, such as micromagnetics, atomistic spin dynamics, and Monte Carlo simulations. He is interested in obtaining a deeper understanding of fundamental magnetization processes that have the potential to lead to novel energy technologies. Michalis graduated with a Diploma in Physics from the Free University of Berlin and a Doctorate from ETH Zurich. Before joining UL Lafayette, he was a senior scientist at ETH Zurich after a two-year postdoctoral stay at UC Berkeley.