Materials Science & Engineering Seminar Series

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Shining Light on Magnetism: Controlled Magnetic Switching With Ultrafast Optical Pulses

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ABSTRACT:
The possibilities of manipulating magnetization without applied magnetic fields have attracted growing attention over the last two decades. The low-power manipulation of magnetization, preferably at ultra-short time scales, has become a fundamental challenge with implications for future magnetic information storage and memory technologies. I will discuss recent experiments on the optical manipulation of the magnetization of engineered materials and devices using 50-5000 fs optical pulses. We demonstrate that all optical switching can be observed in a broad range of materials and not limited to selected rare-earth transition-metal alloy films as had been previously observed [1,2]. This includes optical control of ferromagnetic films and granular recording media that potentially enable breakthroughs for numerous applications since they include materials that are currently used in magnetic data storage, memories and logic technologies. In addition, this materials study of all-optical switching offers valuable insight into the underlying mechanisms involved in optical control of ferromagnetic materials and a pathway to ultrafast spintronics [3, 4].

[1]. Mangin *et al*., Nature Materials **13**, 286–292, (2014).
[2] Lambert *et al.,* Science **345**, 1337-1340 (2014).
[3] S. Iihama *et al*., Adv. Mater. **30**, 1804004 (2018).
[4] G. Li *et al*., Phys. Rev. Mater. **3**, 084415 (2019).

BIOGRAPHY:

Eric Fullerton is a Distinguished Professor at the University of California, San Diego in the Departments of Electrical and Computer Engineering and NanoEngineering and is an Endowed Chair and Director of the Center for Memory and Recording Research. He received his B.Sc. in Physics from Harvey Mudd College in 1984 and his Ph.D. in Physics from UC San Diego in 1991. Before joining UC San Diego, he held research positions at Argonne National Laboratory, the IBM Almaden Research Center and Hitachi Global Storage Technologies. His current research focuses on the synthesis and characterization of magnetic nanostructures, both as a probe of materials in reduced dimensions and for the development of novel information technologies. He has co-authored >340 journal articles, been issued 51 US patents, is a Fellow of the American Physical Society and the IEEE and is a member of the National Academy of Engineering.

Doherty Hall 2210, 11:30AM
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