

CSU PHYSICS COLLOQUIUM

“Manipulating the magnetization at the nanoscale with femto-second laser pulses”

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Monday, April 4th at 4:00pm

120 Engineering (Hammond Auditorium)

Abstract

Magnetic materials have been used for information storage for decades, ever since the inception of the first hard drive. The reason for this application is that magnets have well-defined orientations that remain stable for hundreds of years. The traditional method to change such an orientation is with another magnet. However, new mechanisms to manipulate the magnetization are now available, namely, light-matter interaction at the femtosecond scale. Research on this field has exploded since the first observation in 1996 and continues to be a fascinating topic of non-equilibrium physics. In this colloquium, I will discuss the basic principles that give rise to the optical manipulation of magnetism in metals. Then, I will focus on the discoveries and challenges of this research topic. In particular, I will show recent experimental results demonstrating how magnetic solitons appear as fundamental objects [1] and how symmetry plays a role in the nanoscale structural rearrangement of magnets [2]. Finally, I will present recent theoretical advances that will enable the modeling and analytical study of far-from-equilibrium magnetism with an unprecedented accuracy [3].

References:

[1] E. Iacocca et al., Nat. Comm. 10, 1756 (2019); D. Turenne et al., To be published, arXiv:2111.01649 (2022)

[2] N. Zhou Hagström et al., In Review, arXiv:2112.09587 (2022)

[3] K. Rockwell and E. Iacocca, In preparation (2022)

Biography

Ezio Iacocca is an Assistant Professor at UCCS. He completed his Ph.D. in 2014 at the University of Gothenburg, Sweden, under the supervision of Prof. Johan Åkerman. He then received a post-doctoral fellowship from the Swedish Research Council to visit Prof. Mark A. Hofer at CU Boulder. During this time, Iacocca was sponsored by Dr. Thomas J. Silva as an international associate at NIST Boulder. Iacocca started a faculty position at Northumbria University in Newcastle, UK, in 2019 and later joined the Physics and Energy Science department at UCCS in 2021.

Iacocca's group at UCCS focuses on theoretical, analytical, and numerical studies of magnetization dynamics in ultrafast magnetism, artificial spin ices, and spin hydrodynamics. The goal of the group is to gain understanding of non-equilibrium and nonlinear magnetization dynamics and propose magnetic devices for information technologies.