

CSU PHYSICS COLLOQUIUM

“Dzyaloshinskii-Moriya Interaction in Magnetic Multilayers”

Hans Nembach

University of Colorado Boulder

Monday, May 2nd at 4:00pm

120 Engineering (Hammond Auditorium)

Abstract

The Heisenberg exchange is the fundamental exchange interaction, which gives rise to parallel alignment of neighboring spins and leads to ferromagnetic and anti-ferromagnetic order. The Dzyaloshinskii-Moriya Interaction (DMI) in contrast favors perpendicular orientation of neighboring spins. The competition of these two exchange interactions can result in canted spin alignment in the bulk, for example in $\alpha - \text{Fe}_2\text{O}_3$, where it leads to weak ferromagnetism. In recent years, DMI originating from the interface between a ferromagnet and a material with large spin-orbit coupling, for example Pt, has gained considerable interest. The DMI gives rise to chiral spin structures, skyrmions, which are candidates for future magnetic memories. It also causes a shift of the spin-wave dispersion for Damon-Eshbach spinwaves, which have a wavevector perpendicular to the applied magnetic field, such that spin-waves with the same wavevector propagating in opposite directions have different frequencies. In my talk, I will give an introduction on how spin-waves can be used to probe the DMI in magnetic multilayer systems. I will present results about how interface modifications can alter the strength of the DMI and will show the impact of DMI on standing waves in magnetic nanostructures.

Biography

Dr. Hans T. Nembach is a research associate at the National Institute of Standards and Technology, NIST, Boulder, Colorado, and senior research associate at the Department of Physics, University of Colorado Boulder. He received his Physics Diploma from the University Stuttgart, Germany, in 1999 and his PhD from the Technical University Kaiserslautern, Germany, in 2006. His research focusses on magnetization dynamics and ultrafast processes. In recent years, he has become especially interested in interfacial phenomena including the Dzyaloshinskii-Moriya Interaction and spin-orbit torques. In 2015 he received the “Distinguished Associate Award” from NIST’s Physical Measurement Laboratory. He is the author of more than 85 publications.