CSU PHYSICS COLLOQUIUM

"Understanding and Controlling Magnetic Relaxation in Highly Magnetic Environments"

Joseph Zadrozny

Colorado State University

Monday, March 9th at 4:00pm

120 Engineering (Hammond Auditorium)

Abstract

Magnetic environments are ubiquitous in the many applications of magnetic molecules. For example, bioimaging applications feature aqueous environments, which are concentrated with magnetic ^{1}H protons. Separately, proposed information storage applications for magnetic molecules assume high densities of magnetic complexes on top of stray magnetic fields in devices. Environmental magnetism is a critical obstacle to the above bioimaging/computing applications because it causes magnetic relaxation to hasten. When relaxation is fast enough, the ability to control the magnetism of molecular species is lost, obviating any of the foregoing uses. Thus, understanding how to control the magnetic properties of molecules in highly magnetic environments is essential to future use.

In this talk, I will discuss strategies that we are establishing to slow down magnetic relaxation for metal-containing molecules through explicit tuning of local magnetic environments. Specifically, we chemically tune the spins in the local environment – the spin bath – to provide tests of how magnetic relaxation processes change when the environment is noisy. We will show, via recent results of ours, that chemical control of nuclear and electronic spins in the immediate vicinity of metal ions can slow down relaxation. The work is a distinct departure from the vast majority of the field, which explores magnetic relaxation in specially designed, nonmagnetic environments. Cutting-edge results from our lab will also be presented.

Biography

Joe started his academic career at Virginia Tech before proceeding to UC Berkeley to obtain a PhD under the tutelage of Prof. Jeffrey R. Long, studying magnetic molecules as potential media for classical information storage. As a postdoc, Joe studied the distinct application of magnetic molecules in quantum information processing and electron paramagnetic resonance. In his independent career, Joe's lab leverages control over molecular magnetism to address challenges in bioimaging and reactivity.