

ANALYTICAL SEMINAR



Josh Koval

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"Innovations in Mössbauer: using lasers to probe the low energy transition of ^{229}Th "

Atomic clocks, which measure time by using lasers to facilitate electrons jumping to higher energy states, have been the basis of electronic timekeeping for the past 75 years. However, nuclear clocks, which rely on examining nuclear (instead of electronic) transitions have been of interest because of their increased precision and stability, since the nucleus is less susceptible to external fields. One major system of interest is the low-energy state of ^{229}Th because its transitions have been shown to be compatible with laser frequencies. Recent developments in Mössbauer spectroscopy (namely, incorporating a vacuum-ultraviolet (VUV) laser) allows for investigation of ^{229}Th . Experimental setups relying on VUV lasers have demonstrated promise in identifying doping sites within ^{229}Th that may result in enhanced precision. Other promising experimental setups use conversion electron Mössbauer spectroscopy to increase the applicability of the heavily limited VUV technique.

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"Single-Particle Dark-Field Scattering Microspectroscopy for Chiral measurements"

Single-particle dark-field scattering microspectroscopy is an optical technique that can measure the scattering spectra of individual nanostructures. Due to high-numerical-aperture illumination, only elastic Rayleigh scattering is collected, and background illumination is rejected. This enables label-free, non-destructive optical characterization without photobleaching or blinking, and provides spectra for each individual nanostructure. However, during chiral measurements, anisotropic nanostructures exhibit strong intrinsic linear dichroism, which causes false chiral signals due to optical imperfections. This seminar will discuss an artifact-free dark-field scattering microspectrometer that can cancel linear dichroism artifacts while preserving intrinsic circular differential scattering.