

RUB Laser Colloquium (December 5th 2025)

Presenter: Daniel Isaac Herman, Ph.D.

Affiliation: Sandia National Laboratories, Albuquerque, NM, USA

Title: Dual-comb sensing and the quantum frontier

Abstract:

Dual optical frequency comb systems enable precision atomic and molecular sensing applications including atmospheric monitoring, high-speed chemical analysis and femtosecond time transfer. In this talk, we review the basics of dual-comb measurements and discuss some real-world use-cases for dual-comb sensors including quantification of agricultural gas emissions. After motivating the use of dual-combs for industrial applications, we will discuss the quantum nature of dual-comb measurements and learn how to use quantum states of light to improve dual-comb metrology.

Bio:

Dan Herman holds a B.A. in Physics from Reed College and a M.S./Ph.D. in Physics from University of Colorado Boulder. Dan's research interests include frequency comb metrology, dual-comb systems, nonlinear optics, atmospheric physics and quantum optics. His dissertation focused on the use of portable near-infrared and mid-infrared dual-combs for atmospheric studies. This work was completed under the guidance of Dr. Nathan Newbury and Dr. Ian Coddington at the National Institute of Standards and Technology. He has also contributed to the fields of femtosecond laser stabilization, laser noise analysis and recently, quantum frequency comb metrology. After spending time with IRSweep US and the group of Prof. Scott Diddams (CU-Boulder), he has moved to Sandia National Laboratories where he received the Truman Fellowship award to further advance applications of frequency comb technology.