Title: Broad bandwidth synthesis and spectroscopy with laser frequency combs

Scott Diddams (NIST, USA)

Abstract: A laser frequency comb provides a vast array of absolutely known and precisely controlled spectral lines that can be used for direct spectroscopy as well as spectral calibration. In this talk, we present recent laser and nonlinear optics advances that extend laser frequency comb spectral coverage from 350 nm to beyond 20,000 nm. This is accomplished with robust erbium-fiber laser technology in the 1550 nm region that pumps nonlinear photonic platforms such as lithium niobate, gallium phosphide, and silicon nitride. Of particular interest is a simple and robust method for generating frequency combs spanning the 6-20 micron fingerprint region through intra-pulse difference frequency generation in an orientation-patterned gallium phosphide crystal. This frequency comb is orders of magnitude brighter than thermal light sources and comparable to infrared beam lines at synchrotron user facilities. We demonstrate the utility of our unique, coherent light source for high-resolution (100 MHz), dual-comb spectroscopy of molecular compounds.

Scott Diddams is a Fellow of the National Institute of Standards and Technology (NIST) where he carries out experimental research in the fields of precision spectroscopy and metrology, nonlinear optics, microwave photonics and ultrafast lasers. He received the Ph.D. degree from the University of New Mexico in 1996. From 1996 through 2000, he did postdoctroral work at JILA, NIST and the University of Colorado. Together with colleagues at JILA, he built the first self-referenced, octave-spanning optical frequency comb and used it to produce carrier-envelope phase stabilized pulses. Since 2000, Diddams has been a research physicist at NIST and is the leader of the Optical Frequency Measurements group. He has continued the development of optical frequency combs and pioneered their use in optical clocks, tests of fundamental physics, novel spectroscopy in the visible and mid-infrared, and ultralow noise frequency synthesis. In recent years, special attention has been given to infrared frequency comb sources as well as high repetition rate laser-based and microresonator frequency combs, which are being explored for applications in microwave photonics and astronomy. Dr. Diddams was a recipient of the Department of Commerce gold and silver medals for "revolutionizing the way frequency is measured" as well as the Presidential Early Career Award in Science and Engineering (PECASE) for his work on optical frequency combs. He is a Fellow of the Optical Society of America and the American Physical Society, and a Professor Adjoint at the University of Colorado.