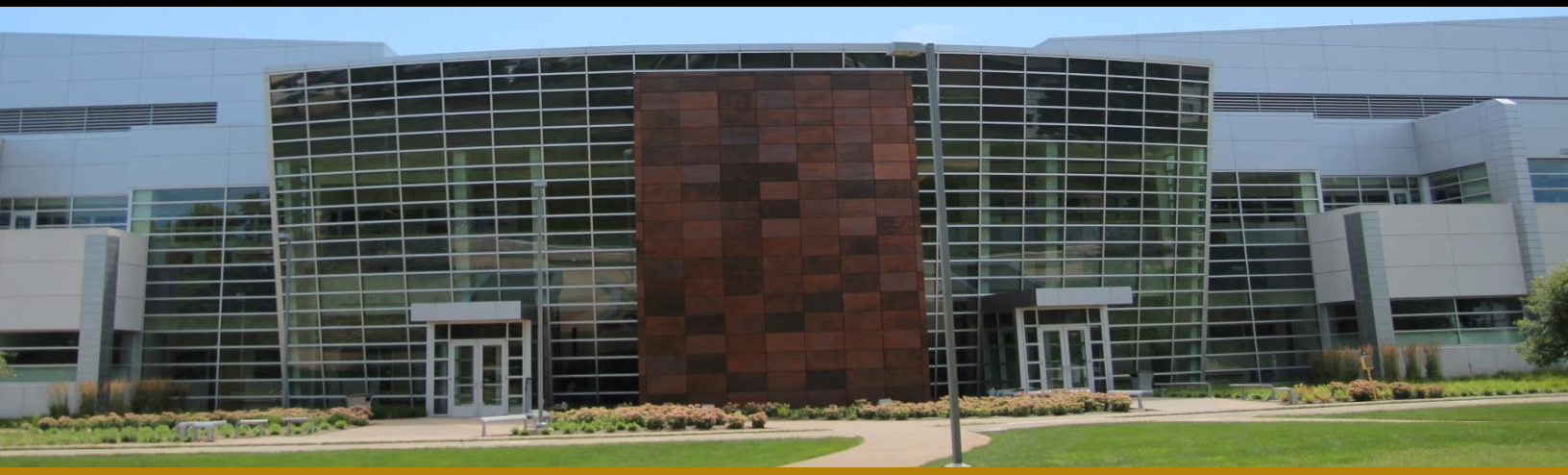
PURDUE UNIVERSITY



Birck Nanotechnology Center

Konstantin L. Vodopyanov obtained his MS from the Moscow Institute of Physics and Technology ("Phys-Tech") and his PhD and DSc (Habilitation) from the Oscillations Lab. of Lebedev Physical Institute (later General Physics Inst.), led by Nobel Prize winner Alexander Prokhorov. Konstantin served an assistant professor at the Moscow Phys-Tech (1985-90), an Alexander-von-Humboldt Fellow at the University of Bayreuth in Germany (1990-92), and as a Royal Society postdoctoral fellow and lecturer at Imperial College, London, UK (1992-98). In 1998, he moved to the United States and became head of the laser group at Inrad, Inc., NJ (1998-2000), and later director of mid-IR systems at Picarro, Inc.,CA (2000-2003). His other industry experience includes co-founding and providing technical guidance for several US and European companies. In 2003 he returned to Academia (Stanford University, 2003-2013) and is now a 21st Century Scholar Chair & Professor of Optics at CREOL, College of Optics & Photonics, Univ. Central Florida. Dr. Vodopyanov is a Fellow of the American Physical Society (APS), Optical Society of America (OSA), SPIE - International Society for Optical Engineering, UK Institute of Physics (IOP). He has > 350 technical publications and is member of program committees for several major laser conferences including CLEO (most recent, General Chair in 2010) and Photonics West (Conference Chair). His research interests include nonlinear optics, mid-IR and terahertz-wave generation, ultra broadband frequency combs and their spectroscopic and biomedical applications.

Massively parallel sensing of molecules with mid-infrared frequency combs

Konstantin L. Vodoyanov

Thursday, June 21st
11:00am – 12:00pm
BRK 2001

Mid-infrared spectroscopy offers supreme sensitivity for detection of trace gases, solids and liquids, based on specific for this spectral region telltale vibrational bands. I will present a new platform for mid-infrared spectroscopy, based on a pair of mutually coherent and broadband frequency combs. The combs are created via subharmonic generation (an inverse process with respect to the second harmonic generation) and span over 3.1–5.5 μm spectral interval. Our system provides fast (time scale of seconds) and simultaneous acquisition of 350,000 spectral data points and we demonstrate parallel detection of 22 trace molecular species in a gas mixture including isotopologues containing such isotopes as 13C, 18O, 17O, 15N, 34S, 33S and deuterium, with part-per-billion sensitivity and sub-Doppler resolution. The technique also features absolute optical frequency referencing to atomic clock and feasibility for kHz-scale spectral resolution.

PURDUE UNIVERSITY Discovery Park