OSA
Optical Society of America

LACSEA

Laser Applications to Chemical, Security and Environmental Analysis

Topical Meetings and Tabletop Exhibit

February 5–9, 2006

Hyatt Regency Lake Tahoe Resort, Spa and Casino, Incline Village, Nevada
Incline Village, Nevada Information

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- Azer Yalin, *Colorado State Univ., USA*

About LACSEA

New developments in optical sources, instrumentation and spectroscopic techniques are principal driving forces for the increased use of lasers in chemical, biophysical and biochemical analysis as well as environmental measurements. These developments arise in a variety of fields and technology areas, promoting the need for an international, interdisciplinary forum to communicate advances to scientists and engineers in the field. The 10th topical meeting is intended to continue the tradition of state-of-the-art research and applications presented in an informal atmosphere designed to foster communication among researchers and practitioners. In addition to the topics traditionally presented at the conference, this year's committee intends to add emphasis to homeland security as a field of scientific activities to which optical methods and spectroscopic techniques can significantly contribute. To emphasize this broadened spectrum of scientific topics, the topical meeting's name has been changed to Laser Applications to Chemical, Security and Environmental Analysis (LACSEA).

Meeting Topics

Topics to be covered:

- Security issues in view of laser-based methods
- Atmospheric measurements; environmental issues
- Laser diagnostics in combustion
- Laser techniques for biochemical/biophysical applications
- Chemical monitoring by optical methods
- Micro-optical systems for chemical analysis
- New instrumentation and innovative optical methods

LACSEA Invited Speakers by Topic:

Security

MA1, **Visible and UV Coherent Raman Spectroscopy of Anthrax Endospores Marker Molecules,** *Marlan O. Scully [1,2] ; [1]Inst. for Quantum Studies, Texas A&M Univ., USA, [2]Princeton Univ., USA.*

MA2, **The Development of Ultraviolet Cavity Ring-Down Spectroscopy for the Detection of Vapors of Explosives and Explosive-Related Compounds,** *Paul J. Dagdigian, Christopher Ramos; Johns Hopkins Univ., USA.*

MC1, **Current Status and New Developments in Spectroscopy-Based Bio-Sensor Technology for Security Applications,** *Jay Eversole; NRL, USA.*

MC2, **Bio-Optical,** *Kumar Patel; Pranalytica Inc., USA.*

LIBS

WA1, **New Plasma Regimes for Stand-off LIBS,** *Martin Richardson; Univ. of Central Florida, USA.*

ThD1, **New Frontiers in LIBS for Bio and Nano Applications,** *Richard Russo; Lawrence Berkeley Natl. Lab, USA.*

ThD2, **LIBS: A New Tool for Forensic Analyses,** *Michael Sigman, Candice Bridge, Katie Vomvoris, Jean M. MacInnis; Natl. Ctr. for Forensic Sciences and Dept. of Chemistry, Univ. of Central Florida, USA.*

Environmental / Atmospherica / Industrial

TuA1, **Airborne Lidar Applications to Global Investigations of Ozone, Water Vapor, Aerosols and Clouds,** *Ed Browell; NASA Langley Res. Ctr., USA.*

TuC1, **Field Diode-Laser Applications in Industry and Research,** *Peter Werle; Natl. Inst. of Applied Optics, Italy.*

WB1, ***In Situ*** **Absorption Spectrometers Using Near-IR Diode Lasers and Rugged Multi-Path-Optics for Environmental Field Measurements,** *Volker Ebert; Univ. of Heidelberg, Germany.*

ThA1, **Recent Advances and Applications of Semiconductor Laser Based Gas Sensor Technology,** *Frank K. Tittel, Yury A. Bakhirkin, Anatoliy A. Kosterev, Matthew R. McCurdy, Trinesha Mosely, Stephen G. So, Gerard Wysocki; Rice Univ., USA.*

Bio-Optical

TuD1, **Current Status of Clinical Breath Analysis,** *Terence H. Risby; Johns Hopkins Univ., USA.*

TuD2, **Mid-IR Laser Spectrometers for Breath Analysis,** *Pat McCann; Ekips Technologies Inc., USA.*

Combustion

MB1, **Imaging Scalar Dissipation in Flames,** *Marshall Long[1], Sebastian A. Kaiser[2], Jonathan H. Frank[2]; [1]Yale Univ., USA, [2]Sandia Natl. Labs, USA.*

TuB1, **Laser Combustion Diagnostics, Application to Engines,** *Volker Sick; Univ. of Michigan, USA.*

ThC1, **Advances in Diode Laser Absorption Sensors for Combustion and Propulsion,** *Ronald K. Hanson; Stanford Univ., USA*.

New Methods / Light Sources

MD1, **Progress on DFG Laser Sources and Its Application to Ultra-Sensitive Trace Gas Detection,** *Dirk Richter, Petter Weibring, Alan Fried, James G. Walega; NCAR, USA.*

ThB1, **New Light Sources - Wide Tuning Range and Rapid Scanning Blue Extended Cavity Diode Lasers,** *Johan Hult, Iain S. Burns, Clemens F. Kaminski; Univ. of Cambridge, UK.*

LACSEA Agenda of Sessions

Sunday, February 5, 2006

Time	Event/Location
2:00 p.m. - 5:00 p.m.	Registration *Lakeside Foyer*

Monday, February 6, 2006

Time	Event/Location
7:00 a.m. - 5:00 p.m.	Registration *Lakeside Foyer*
8:00 a.m. - 8:15 a.m.	Opening Remarks *Lakeside C Ballroom*
8:30 a.m. - 10:05 a.m.	**MA:** Security I *Lakeside C Ballroom*
10:05 a.m. - 4:00 p.m.	Exhibits *Lakeside A&B Ballroom*
10:05 a.m. - 10:30 a.m.	Coffee Break & Exhibits *Lakeside A&B Ballroom*
10:30 a.m. - 12:00 p.m.	**MB:** Combustion I *Lakeside C Ballroom*
12:00 p.m. - 1:00 p.m.	Lunch (On Your Own)
1:00 p.m. - 2:50 p.m.	**MC:** Security II *Lakeside C Ballroom*
2:50 p.m. - 3:05 p.m.	Coffee Break & Exhibits *Lakeside A&B Ballroom*
3:05 p.m. - 5:15 p.m.	**MD:** New Methods & Instrumentation I *Lakeside C Ballroom*
5:30 p.m. - 7:30 p.m.	Conference Reception Regency Ballroom B-F

Tuesday, February 7, 2006

Time	Event/Location
7:30 a.m. - 5:00 p.m.	Registration *Lakeside Foyer*
8:30 a.m. - 10:00 a.m.	**TuA:** Environmental/Atmospheric/Industrial I *Lakeside C Ballroom*
10:00 a.m. - 3:10 p.m.	Exhibits *Lakeside & B Ballroom*
10:00 a.m. -10:20 a.m.	Coffee Break & Exhibits *Lakeside A&B Ballroom*
10:20 a.m. - 11:50 a.m.	**TuB:** Combustion II *Lakeside C Ballroom*
11:50 a.m. - 1:00 p.m.	Lunch (On Your Own)
1:00 p.m. – 2:50 p.m.	**TuC:** Environmental/Atmospheric/Industrial II *Lakeside C Ballroom*
2:50 p.m. – 3:10 p.m.	Coffee Break & Exhibits *Lakeside A&B Ballroom*
3:10 p.m. – 5:30 p.m.	**TuD:** Bio-Optical *Lakeside C Ballroom*
5:30 p.m. – 7:00 p.m.	Dinner Break (On Your Own)
7:00 p.m. – 9:00 p.m.	**TuE**: Poster Session & Exhibits *Lakeside A & B Ballroom*

Wednesday, February 8, 2006

Time	Event/Location
8:00 a.m. – 12:00 p.m.	Registration *Lakeside Foyer*
8:30 a.m. - 10:00 a.m.	**WA:** LIBS I *Lakeside C Ballroom*
10:00 a.m. - 10:20 a.m.	Coffee Break *Lakeside Foyer*
10:20 a.m. - 11:50 a.m.	**WB:** Environmental/Atmospheric/Industrial III *Lakeside C Ballroom*
11:50 a.m. - 12:30 p.m.	Free Afternoon (On Your Own)

Thursday, February 9, 2006

Time	Event/Location
8:00 a.m. – 5:00 p.m.	Registration *Lakeside Foyer*
8:30 a.m. - 10:00 a.m.	**ThA:** Environmental/Atmospheric/Industrial IV *Lakeside C Ballroom*
10:00 a.m. - 10:20 a.m.	Coffee Break *Lakeside Foyer*
10:20 a.m. - 11:50 a.m.	**ThB: New Methods & Instrumentation II** *Lakeside C Ballroom*
11:50 a.m. - 1:00 p.m.	Lunch Break (On Your Own)
1:00 p.m. – 2:50 p.m.	**ThC: Combustion III** *Lakeside C Ballroom*
2:50 p.m. – 3:20 p.m.	Coffee Break *Lakeside Foyer*
3:20 p.m. – 5:20 p.m.	**ThD: LIBS II** *Lakeside C Ballroom*
5:20 p.m. – 5:40 p.m.	**Closing Remarks** *Lakeside C Ballroom*

LACSEA would like to thank the U.S. Army Research Office for their generous contribution.

LACSEA Abstracts

Monday, February 6, 2006

Lakeside C
MA • Security I
8:30 a.m.–10:05 a.m.
James R. Gord; AFRL, USA, Presider

MA1 • 8:30 a.m. KEYNOTE
Visible and UV Coherent Raman Spectroscopy of Anthrax Endospores Marker Molecules, *Marlan O. Scully[1,2]; [1]Inst. for Quantum Studies, Texas A&M Univ., USA, [2]Princeton Univ., USA.* We use FAST CARS, ie, time-resolved femtosecond coherent Raman spectroscopy, to obtain molecule-specific signals from dipicolinic acid (DPA), which is a marker molecule for bacterial spores. Experiments are carried out in both visible and UV spectral regions and we compare experimental results with theoretical predictions. By exciting vibrational coherence on more than one mode simultaneously, we observe a quantum beat signal that can be used to extract the parameters of molecular motion in DPA.

MA2 • 9:15 a.m. INVITED
The Development of Ultraviolet Cavity Ring-Down Spectroscopy for the Detection of Vapors of Explosives and Explosive-Related Compounds, *Paul J. Dagdigian, Christopher Ramos; Johns Hopkins Univ., USA.* The detection of dinitrobenzenes and dinitrotoluenes by UV cavity ring-down absorption spectroscopy is investigated. We show that these compounds can be detected at sub-ppb concentration levels through measurements at a single wavelength.

MA3 • 9:45 a.m.
Detection of Explosive and Explosive Related Compounds (ERCs) Using Ultrafast Laser Photoionization Time of Flight Mass Spectrometry, *Christopher Mullen, Jennifer Ha, Michael J. Coggiola, Harald Oser; SRI Intl., Molecular Physics Lab, USA.* Ultrafast laser photoionization time of flight mass spectrometry has been applied to the detection of explosives and explosive related compounds. The wavelength dependence of the photoionization event and the sensitivity of the technique are discussed.

Lakeside C
MB • Combustion I
10:30 a.m.–12:00 p.m.
Terrence R. Meyer; Innovative Scientific Solutions, Inc., USA, Presider

MB1 • 10:30 a.m. INVITED
Imaging Scalar Dissipation in Flames, *Marshall Long[1], Sebastian A. Kaiser[2], Jonathan H. Frank[2]; [1]Yale Univ., USA, [2]Sandia Natl. Labs, USA.* Simultaneous imaging of mixture fraction, temperature, scalar dissipation and reaction rate in a turbulent flame is described. Measurements are based on the detection of polarized/ depolarized Rayleigh scattering and PLIF measurements of OH and CO.

MB2 • 11:00 a.m.
Imaging Studies of Swirl-Stabilized Premixed Flames, *Per Petersson[1], Christian Brachman[1], Hans Seyfried[1], Jimmy Olofsson[1], David Sedarsky[1], Mark Linne[1], Marcus Alden[1], Andreas Nauert[2], Andreas Dreizler[2]; [1]Lund Inst. of Technology, Sweden, [2]Technical Univ. of Darmstadt, Germany.* Swirl-stabilized flames have been studied using imaging techniques, for LES code validation. Rapid framing PLIF has been combined with simultaneous PIV. Rapid imaging of chemiluminescent emission provided information on dynamic events such as flash-back.

MB3 • 11:20 a.m.
Laser-Induced Fragmentation Fluorescence of Vinyl and Acetylene, *Jonathan H. Frank, David L. Osborn, Nils Hansen; Sandia Natl. Labs, USA.* Laser-induced fragmentation fluorescence from $C_2(d^3\Pi_g \rightarrow a^3\Pi_u)$ provides a detection strategy for vinyl and acetylene. The efficiency of $C_2(d^3\Pi_g)$ production via multi-photon photodissociation depends on the H-atom loss mechanism and the internal energy of the precursor molecule.

MB4 • 11:40 a.m.
High-Speed Laser Imaging, Heat Flux and Temperature Measurements of Explosions, *Thuvan N. Piehler, Barrie Homan, Rachel Ehlers, Richard Lottero, Kevin L. McNesby; ARL, USA.* This presentation reports results of optical temperature, emission and heat flux measurements of fireballs produced by conventional and "enhanced blast" explosives.

Lakeside C
MC • Security II
1:00 p.m.–2:50 p.m.
Paul J. Dagdigian; Johns Hopkins Univ., USA, Presider

MC1 • 1:00 p.m. KEYNOTE
Current Status and New Developments in Spectroscopy-Based Bio-Sensor Technology for Security Applications, *Jay Eversole; NRL, USA.* This presentation overviews bio-detection research and development based on optical measurement techniques. Application concepts-of-operation, connection between measurement specificity and sensor performance, potential relevant optical phenomenologies and a summary of active development programs will be discussed.

MC2 • 1:45 p.m. KEYNOTE
Bio-Optical
Kumar Patel; Pranalytica Inc., USA.

MC3 • 2:30 p.m.
Fiber-Optic MIR Laser Sensors for Explosive Detection, *Wolfgang Schade, Ashwini K. Sharma, Sandra Börner, Claus Romano; Technische Univ. Clausthal, Germany.* Mid-infrared laser radiation at 8.05 µm is generated by DFG in $AgGaS_2$ for the detection of the explosive TATP. Fiber coupled absorption and evanescent field sensors are developed for sensive and selective remote detection.

Lakeside C
MD • New Methods & Instrumentation I
3:05 p.m.–5:15 p.m.
Thomas Settersten; Sandia Natl. Labs, USA, Presider

MD1 • 3:05 p.m. INVITED
Progress on DFG Laser Sources and Its Application to Ultra-Sensitive Trace Gas Detection, *Dirk Richter, Petter Weibring, Alan Fried, James G. Walega; NCAR, USA.* Tunable mid-IR laser sources based upon fiber optic pumped difference-frequency generation (DFG) have recently made significant progress. Several advances in the design of DFG sources and detection schemes permit ultra-sensitive detection of $A_{min} \sim 1 \times E^{-7}$.

MD2 • 3:35 p.m.
Spectral Control of CW OPOs and Their Application to Mid-Infrared Spectroscopy, *Angus J. Henderson[1], Ryan Stafford[1], J. Houston Miller[2], Frank K. Tittel[3], Anatoliy Kosterev[3], Tom Killian[3]; [1]Aculight Corp, USA, [2]George Washington Univ., USA, [3]Rice Univ., USA.* A fiber-laser-pumped CW OPO operating at 3170nm with a linewidth of 1MHz will be reported. We will describe spectral control of the output and its application to different spectroscopic measurement techniques.

MD3 • 3:55 p.m.
Singlemode Room-Temperature CW Operation and High Power Pulsed Operation of Quantum Cascade Lasers, *Antoine Muller, S. Blaser, L. Hvozdara, H. Page; Alpes Lasers, Switzerland.* Singlemode 1900cm^{-1} laser operating in continuous wave based on bound to continuum design is reported; it exhibits a maximum power of 60mW at -30°C. Fabry-Pérot devices exhibiting 200mW average power centred at 2240cm^{-1} at -30°C.

MD4 • 4:15 p.m.
Eigenmode Based Simulation of Quantum Cascade Laser Sources in Pulsed Cavity Ring-Down Spectroscopy, *Adam B. Boyts, Christopher B. Dreyer; Colorado School of Mines, USA.* A numerical simulation of pulsed Cavity Ring-Down Spectroscopy using Quantum Cascade Laser sources is presented. The effects of a theoretical absorption feature on energy output and ring-down time constants are investigated.

MD5 • 4:35 p.m.
Ultra-Sensitive Absorption Measurements Using Cavity-Enhanced Frequency Modulation Spectroscopy, *David L. Osborn, Joakim Bood, Andrew McIlroy; Sandia Natl. Labs, USA.* We use cavity-enhanced frequency modulation absorption spectroscopy in the first measurement of the sixth overtone band of NO near 797 nm. The high detection sensitivity achieved ($2 \cdot 10^{-10}$ $cm^{-1}Hz^{-1/2}$) shows promise for trace gas monitoring applications.

MD6 • 4:55 p.m.
Nonresonant-Background-Free Broadband Coherent Anti-Stokes Raman Spectroscopy Using Picosecond Lasers, *Sukesh Roy[1], Terrence R. Meyer[1], James R. Gord[2]; [1]Innovative Scientific Solutions, Inc., USA, [2]AFRL, USA.* Nonresonant-background-free broadband picosecond coherent anti-Stokes Raman scattering (CARS) spectroscopy of nitrogen is demonstrated using 145-ps pump and probe beams and a 115-ps Stokes beam with a spectral bandwidth of 5 nm.

Tuesday, February 7, 2006

Lakeside C
TuA •
Environmental/Atmospheric/Industrial I
8:30 a.m.–10:00 a.m.
Alan Fried; Natl. Ctr. for Atmospheric Res, USA, Presider

TuA1 • 8:30 a.m. INVITED
Airborne Lidar Applications to Global Investigations of Ozone, Water Vapor, Aerosols and Clouds, *Ed Browell; NASA Langley Res. Ctr., USA.* Airborne lidar systems make major contributions to global investigations of many important atmospheric chemistry and meteorological processes. This paper discusses these lidar systems and results from recent studies of ozone, water vapor, aerosols, and clouds.

TuA2 • 9:00 a.m.
Trace Humidity Sensor Based on Quartz-Enhanced Photoacoustic Spectroscopy, *Anatoliy A. Kosterev[1], Frank K. Tittel[1], Trevor S. Knittel[2], Alan Cowie[2], James D. Tate[3]; [1]Rice Univ., USA, [2]Analytical Specialties, Inc., USA, [3]Dow Chemical, USA.* A compact trace humidity sensor based on quartz enhanced photoacoustic spectroscopy (QEPAS) technique was designed and characterized. A sensitivity of 2.5×10^{-9} $cm^{-1}W/Hz^{½}$ was achieved. An influence of oxygen presence on the detected signal was observed.

TuA3 • 9:20 a.m.
Cavity-Enhanced Instrumentation for Atmospheric Monitoring, *Doug Baer[1], Robert Provencal[1,2], Manish Gupta[1], Tom Owano[1], Anthony O'Keefe[1], Ken Ricci[1], Randy L. Apodaca[2], James D. Ayers[2], William R. Simpson[2]; [1]Los Gatos Res, USA, [2]Univ. of Alaska at Fairbanks, USA.* The performance of instruments based on Off-Axis ICOS for measurements in the field of CH_4 and NO_3 using near-infrared diode lasers and CO and N_2O using quantum-cascade lasers will be presented.

TuA4 • 9:40 a.m.
Using Water Clouds for Lidar Calibration, *Yongxiang Hu; NASA, USA.* Water clouds are feasible calibration targets. The accuracy of the method is linked to the understanding about multiple scattering. Here, a highly accurate relation between multiple scattering factor and the measured depolarization ratios is established.

Lakeside C
TuB • Combustion II
10:20 a.m.–11:50 a.m.
Andreas M. Dreizler; TU Darmstadt, Germany, Presider

TuB1 • 10:20 a.m. INVITED
Laser Combustion Diagnostics, Application to Engines, *Volker Sick; Univ. of Michigan, USA.* Laser-induced fluorescence of biacetyl is used to measure the temporal evolution of fuel distributions at rates of 12 kHz in a gasoline direct-injection engine with a frequency-tripled diode-pumped Nd:YAG laser and an image-intensified CMOS camera.

TuB2 • 10:50 a.m.
Measurements of Gas Temperature in an HCCI Engine by Use of a Fourier-Domain Mode-Locking Laser, *Laura A. Kranendonk[1], Joachim W. Walewski[1], Scott T. Sanders[1], Robert J. Huber[2], James G. Fujimoto[2]; [1]Univ. of Wisconsin at Madison, USA, [2]MIT, USA.* Initial measurements of water vapor temperature by use of a Fourier-domain mode-locking laser were performed in a homogenous charge compression ignition engine. We assessed the potential of this FDML laser in combustion applications.

TuB3 • 11:10 a.m.
Multispecies Monitoring of a Static Internal Combustion Engine by NIR Diode Laser Sensors, *Yvan Gérard, Robert J. Holdsworth, Philip A. Martin; Univ. of Manchester, United Kingdom.* A multispecies near-infrared diode laser spectrometer has been constructed for measurements of carbon monoxide, carbon dioxide and methane directly in the exhaust of a static internal combustion engine under different operating conditions.

TuB4 • 11:30 a.m.
Temperature Diagnostics Using Laser-Induced Fluorescence (LIF) of Toluene, *Frank P. Zimmermann[1], Wieland Koban[1], Christof Schulz[2]; [1]PCI, Univ. Heidelberg, Germany, [2]IVG, Univ. Duisburg-Essen, Germany.* Three properties of toluene-LIF have been found to depend on temperature. With increasing temperature: 1) total signal intensity decreases 2) emission-spectrum shifts to the red and 3) effective fluorescence-lifetimes decrease. Each effect enables quantitative *T*-measurements.

Lakeside C
TuC • Environmental/Atmospheric/ Industrial II
1:00 p.m.–2:50 p.m.
Volker Ebert; Phys Chem Inst. Univ. Heidelberg, Germany, Presider

TuC1 • 1:00 p.m. INVITED
Field Diode-Laser Applications in Industry and Research, *Peter Werle; Natl. Inst. of Applied Optics, Italy.* Diode-lasers find increasingly applications in industry, medicine and environmental monitoring, but still measurements challenges have to be solved in the fields of stable isotopes, trace gas emissions from ecosystems and on in-situ airborne stratospheric platforms.

TuC2 • 1:30 p.m.
Mid-IR ICL-Based Sensor for Field Measurements of Ambient CH_4, *David M. Sonnenfroh, Michelle Silva, Mark Allen; Physical Sciences Inc., USA.* We describe some of the design considerations for a mid-IR ICL-based sensor for field measurements of CH_4. Initial data from recent field trials will be discussed.

TuC3 • 1:50 p.m.
Detection of Formaldehyde Using Off-Axis Integrated Cavity Output Spectroscopy with an Interband Cascade Laser, *J. Houston Miller[1], Yury A. Bakhirkin[2], Tibor Ajtai[2], Frank K. Tittel[2], Cory J. Hill, Baohua Yang, Rui Q. Yang; [1]George Washington Univ., USA, [2]Rice Univ., USA, [3]JPL, USA.* A continuous-wave, mid-infrared, distributed feedback, interband cascade laser was used to detect and quantify formaldehyde (H_2CO) using off axis, integrated cavity output spectroscopy in gas mixtures ranging from 1-25 ppmV in H_2CO.

TuC4 • 2:10 p.m.
Absorption Characterization of Aerosols by Cavity Ringdown Technique, *Valery Bulatov, Yuheng Chen, Israel Schechter; Technion-Israel Inst. of Technology, Israel.* Cavity ring-down laser absorption spectroscopy was applied for aerosols measurements. Sensitive detection of aerosols under ambient conditions was achieved. An absorption band was observed for dye aerosols, which indicates the possibility of selective analysis.

TuC5 • 2:30 p.m.
Fragmentation of Nanoparticle Soot Aggregates during Pulsed Laser Heating: A Combined SMPS, TEM, NEXAFS, and Modeling Study, *Hope A. Michelsen[1], Mark A. Dansson[1], Michael Gershenzon[1], Alexei Tivanski[2], Mary K. Gilles[2], Laura Van Poppel[3], Peter Buseck[3]; [1]Sandia Natl. Labs, USA, [2]Lawrence Berkeley Natl. Lab, USA, [3]Arizona State Univ., USA.* Carbonaceous nanoparticles formed from laser-heated soot aggregates were studied using electric mobility sizing, transmission electron microscopy, and near-edge x-ray absorption fine structure spectroscopy. The results suggest that nanoparticle formation proceeds through volatilization/re-condensation of carbon clusters.

Lakeside C
TuD • Bio-Optical
3:10 p.m.–5:30 p.m.
Clemens F. Kaminski; Univ. of Cambridge, United Kingdom, Presider

TuD1 • 3:10 p.m. INVITED
Current Status of Clinical Breath Analysis, *Terence H. Risby; Johns Hopkins Univ., USA.* This presentation will review the current status of clinical breath analysis, suggest reasons for this status and identify future directions for the field.

TuD2 • 3:40 p.m. INVITED
Mid-IR Laser Spectrometers for Breath Analysis, *Pat McCann; Ekips Technologies Inc., USA.* Mid-IR laser spectrometers suitable for use in clinical settings have been developed. Initial results with measuring exhaled NO for assessing airway inflammation show that such spectrometers are promising instruments for medical diagnostic applications.

TuD3 • 4:10 p.m.
Vertical Cavity Laser and Passive Fabry Perot Interferometer Based Microfluidic Biosensors, *Dhiraj Kumar, Hua Shao, Kevin L. Lear; Colorado State Univ., USA.* Passive and active microfluidic Fabry-Perot vertical cavity based biosensors were designed and fabricated for the detection of biological cells. Transmission spectra of single polystyrene spheres, yeast cells, and blood cells inside optical cavities are reported.

TuD4 • 4:30 p.m.
Detection of NO and ^{15}NO from Liquid-Phase Reactions Involving NO-Generating Organic, Inorganic, and Biological Samples Using a Mid-Infrared Laser, *Khosrow Namjou[1], Jun Yi[2], Zaki N. Zahran[2], George B. Richter-Addo[2], Patrick J. McCann[3]; [1]Ekips Technologies, USA, [2]Dept. of Chemistry and Biochemistry, Univ. of Oklahoma, USA, [3]School of Electric and Computer Engineering, Univ. of Oklahoma, USA.* A mid-infrared laser spectrometer was used for specific detection of NO and ^{15}NO from decomposition of NO-containing organic, heme model, and protein compounds. The method does not depend on any chemical derivatization of NO.

TuD5 • 4:50 p.m.
Measurement of Exhaled Nitric Oxide in Newly Received Steers Using Tunable Diode Laser Absorption Spectroscopy, *Chad B. Roller[1], Ben P. Holland[2], Gina McMillen[1], Clint R. Krehbiel[2], Douglas L. Step[3], Khosrow Namjou[1], Patrick J. McCann[4]; [1]Ekips Technologies, Inc., USA, [2]Dept. of Animal Science, Oklahoma State Univ., USA, [3]College of Veterinary Medicine, Food Animal Sciences, Oklahoma State Univ., USA, [4]School of Electrical and Computer*

Engineering, Univ. of Oklahoma, USA. Measurement of exhaled nitric oxide (eNO) was performed on beef cattle using a tunable diode laser absorption spectrometer (TDLAS). A mean eNO concentration for beef cattle upon delivery was found to be 331 ppt (n=319).

TuD6 • 5:00 p.m.
Quantum Cascade Laser-Based Nitric Oxide Detection in Exhaled Breath of Patients with Chronic Obstructive Pulmonary Disease, *Matt McCurdy[1,2], Yury A. Bakhirkin[1], Frank K. Tittel[1], Amir Sharafkhaneh[2]; [1]Rice Univ., USA, [2]Baylor College of Medicine, USA.* A continuous wave quantum cascade laser operating at 5.45 μm coupled with integrated cavity output spectroscopy and wavelength modulation is detecting nitric oxide in exhaled breath of subjects with chronic obstructive pulmonary disease.

Lakeside A & B
TuE • Poster Session
7:00 p.m.–9:00 p.m.

TuE1 • 7:00 p.m.
The Use of Photoacoustic Spectroscopy in Materials Science Research, *Alistair M. Parkes, Edward D. McNaghten, Katherine A. Keen; AWE plc, United Kingdom.* Different methods of tunable diode laser photoacoustic spectroscopy for trace gas detection will be presented. We will compare the use of conventional microphones and a novel cantilever style microphone.

TuE2 • 7:00 p.m.
Measurements of Direct Quenching from NO $A\,^2\Sigma^+(v'=0)$ to $X\,^2\Pi(v''=0)$, *Brian D. Patterson[1], Thomas B. Settersten[1], Helmut Kronemayer[2], Volker Sick[3], Wolfgang G. Bessler[2], Christof Schulz[4], John W. Daily[5]; [1]Sandia Natl. Labs, USA, [2]Univ. Heidelberg, Germany, [3]Univ. of Michigan, USA, [4]Univ. Duisburg-Essen, Germany, [5]Univ. of Colorado, USA.* Direct quenching to the NO ground state was measured in a room-temperature flow cell. An intense nanosecond laser at 226.3 nm depleted the ground-state population, and a weak picosecond laser probed the recovery.

TuE3 • 7:00 p.m.
Fluorescence Excitation Spectra from Individual Bioaerosol Particles, *Albert Manninen, Matti Putkiranta, Toni Laurila, Antti Rostedt, Jorma Keskinen, Rolf Hernberg; Tampere Univ. of Technology, Finland.* We describe the experimental set-up for measuring fluorescence spectra from individual aerosol particles with tunable excitation wavelengths. Fluorescence spectra from individual riboflavin and NAD(P)H doped sodium chloride particles have been obtained.

TuE4 • 7:00 p.m.
Measurements of Aluminium Laser-Induced Breakdown Spectra, *James O. Hornkohl[1], Christian G. Parigger[1], Laszlo Nemes[2], Anna M. Keszler[2]; [1]Univ. of Tennessee, USA, [2]Chemical Res. Ctr., Hungary.* We report measurements of time-averaged and time-resolved emission spectra subsequent to laser-induced optical breakdown of aluminium in laboratory air. Atomic and molecular features are investigated for diagnostics applications in laser materials processing.

TuE5 • 7:00 p.m.
A 551-Picosecond Pulsed Laser-Source for Mid-Infrared LIDAR, *Peter Geiser, Ulrike Willer, Wolfgang Schade; Clausthal Univ. of Technology, Germany.* A new pulsed laser-source for MIR-LIDAR based on difference-frequency generation in PPLN is developed. A pulse duration of 551 ps has been measured using silver thiogallate as non-linear device for an upconversion cross correlation experiment.

TuE6 • 7:00 p.m.
Laser-Induced Phosphorescence for Spray Thermometry, *Jan Brübach, Alexander Pratt, Andreas M. Dreizler; TU Darmstadt, Germany.* It is demonstrated that thermographic phosphors can be used to measure liquid phase temperatures extending the range of their applicability. For this purpose the phosphor $Mg_4F_2GeO_6$:Mn was selected and dispersed into a n-dodecane spray.

TuE7 • 7:00 p.m.
Laser Induced Breakdown Spectroscopy: Application to Tissue Analysis, *Hongbo N. Zheng, Fang Yu Yueh, Shane Burgess, Jagdish P. Singh; Mississippi State Univ., USA.* Laser-induced breakdown spectroscopy (LIBS) is applied to characterize animal tissue samples. Samples include brain, kidney, liver, lung, muscle and spleen tissues.

TuE8 • 7:00 p.m.
On the 400-nm Continuum in Spectra of Laser Ablation Graphite Plasma, *Laszlo Nemes[1], Anna M. Keszler[1], James O. Hornkohl[2], Christian G. Parigger[2]; [1]Chemical Res. Ctr., Hungary, [2]Univ. of Tennessee, USA.* Laser ablation graphite plasma spectra may include a characteristic continuum shape near 400-nm. This continuum may show the

signature of high temperature Swings bands of the C_3 molecule and/or hot carbon particle incandescence.

TuE9 • 7:00 p.m.
Fluorescence Lifetime Imaging Using Cheap LEDs as Illumination: Application in Microchannels, *Alan D. Elder, Johannes Swartling, Sinead M. Matthews, Kamran Yunus, Jonathan H. Frank, Clemens F. Kaminski; Dept. of Chemical Engineering, Univ. of Cambridge, United Kingdom.* We describe a frequency-domain fluorescence lifetime imaging (FLIM) setup that uses cheap LEDs for illumination. Application of this system is demonstrated by measuring lifetime changes caused by the diffusion of iodide ions across a microchannel.

TuE10 • 7:00 p.m.
Evaluating the Potential of Multi-Color Heterodyne Absorption Spectroscopy in Turbulent Combustion, *Joachim W. Walewski, Thilo Krätschmer, Scott T. Sanders; Univ. of Wisconsin at Madison, USA.* We are assessing the potential of multi-color heterodyne spectroscopy for applications to turbulent combustion.

Wednesday, February 8, 2006

Lakeside C
WA • LIBS I
8:30 a.m.–10:00 a.m.
Andrzej Miziolek; US Army, USA, Presider

WA1 • 8:30 a.m. INVITED
New Plasma Regimes for Stand-off LIBS, *Martin Richardson; Univ. of Central Florida, USA.* Laser-induced breakdown spectroscopy is a promising technique for stand-off detection of chemical and biological agents. We discuss the fundamental interaction science that is the basis of this technique and introduce new concepts to this approach.

WA2 • 9:00 a.m.
Wavelength Dependence of Quantitative Emission Levels from Femtosecond Microplasmas for Laser-Induced Breakdown Spectroscopy, *M. T. Taschuk, S. E. Kirkwood, Y. Y. Tsui, R. Fedosejevs; Univ. of Alberta, Canada.* Emission scaling of absolute emission is investigated for Al, Cu and Si microplasmas using 800nm, 115fs laser pulses. Sample properties are important near the breakdown threshold, and a strong dependence on target reflectivity was observed.

WA3 • 9:20 a.m.
Multiple Emission Line Elemental Analysis of LIBS Plasmas for Improved Measurement Accuracy, *Greg Mungas, Eddie Drumheller, Ted Fisher; Firestar Engineering, LLC, USA.* Current LIBS methods for interpreting relative elemental abundance result in large errors in accuracy due to varying plasma temperature. To alleviate this issue, a theoretical algorithm is proposed using multiple emission lines per element.

WA4 • 9:40 a.m.
Laser Induced Breakdown Spectroscopy: Application to Slurry Analysis, *Seong Yong Oh, Tracy Miller, Fang Yu Yueh, Jagdish P. Singh; Mississippi State Univ., USA.* An experiment setup for slurry circulation system was used to record the laser-induced plasma emssion spectra.

Lakeside C
WB •
Environmental/Atmospheric/Industrial III
10:20 a.m.–11:50 a.m.
David M. Sonnenfroh; Physical Sciences Inc., USA, Presider

WB1 • 10:20 a.m. INVITED
***In situ* Absorption Spectrometers Using Near-IR Diode Lasers and Rugged Multi-Path-Optics for Environmental Field Measurements,** *Volker Ebert; Univ. of Heidelberg, Germany. In situ* TDLAS spectrometers for environmental applications are presented: An ultra-light-weight balloon-borne CH_4/H_2O-sensor for stratospheric sounding; a calibration-free H_2O-vapor-sensor for ice clouds; and a robust O_2-spectrometer to analyze dense water sprays during fire suppression.

WB2 • 10:50 a.m.
PPB Level Defection of NO and NO_2 Using Room Temperature High Power Quantum Cascade Lasers, *Michael B. Pushkarsky[1], Alexei Tsekoun[1], Rowel Go[1], C. Kumar N. Patel[1,2]; [1]Pranalytica, Inc., USA, [2]Dept. of Physics and Astronomy, Univ. of California at Los Angeles, USA.* The PPB level detection of NO and NO_2 was achieved using laser-based photoacoustic spectroscopy with high power, room temperature, continuous wave external cavity quantum cascade lasers operating in 5.25 and 6.25 micron spectral regions, respectively.

WB3 • 11:10 a.m.
Transmission Spectra of Diatomic and Triatomic Molecules at High Pressures in the Mid-Infrared and THz Regions,

Hongqian Sun, Yujie J. Ding; Lehigh Univ., USA. We have observed distinct ro-vibrational and rotational transitions in carbon monoxide isotopic variants, carbon dioxide, and nitrogen dioxide by using Fourier-transform infrared spectroscopy.

WB4 • 11:30 a.m.
Room Temperature Terahertz (THz) Spectroscopy of CCl_3F (CFC-11), *Hakan Altan[1], Baolong L. Yu[1], Robert R. Alfano[1], Scott Alfano[2]; [1]City College of New York, City Univ. of New York, USA, [2]Union College, USA.* The rotational spectrum for the lowest vibrational mode for CCl_3F has been measured in the 0.1 to 1.5THz frequency range. The observed absorption profile was well modeled with rotational and vapor pressure parameters.

Thursday, February 9, 2006

Lakeside C
ThA •
Environmental/Atmospheric/Industrial IV
8:30 a.m.–10:00 a.m.
Doug Baer; Los Gatos Res, USA, Presider

ThA1 • 8:30 a.m. INVITED
Recent Advances and Applications of Semiconductor Laser based Gas Sensor Technology, *Frank K. Tittel, Yury A. Bakhirkin, Anatoliy A. Kosterev, Matthew R. McCurdy, Trinesha Mosely, Stephen G. So, Gerard Wysocki; Rice Univ., USA.* Recent developments of sensors based on infrared semiconductor lasers for the detection of trace gas species will be described. Several examples of real world applications in environmental monitoring and medical diagnostics will be reported.

ThA2 • 9:00 a.m.
Development of a Fiber-Laser Based Detector for $HgCl_2$, *Alexandra A. Hoops, Thomas A. Reichardt, Dahv A. V. Kliner; Sandia Natl. Labs, USA.* The performance of a real-time, non-invasive approach to monitoring $HgCl_2$ emissions is evaluated. The calculated detection limit for $HgCl_2$ in a flue-gas environment is 0.2 ppb for a signal integration time of 5 minutes.

ThA3 • 9:20 a.m.
Diode-Laser-Based Sensor for Measuring Atomic Mercury in Coal-Combustion Exhaust, *Thomas N. Anderson, Robert P. Lucht; Purdue Univ., USA.* UV radiation at 253.7 nm is generated by sum-frequency mixing a 784-nm distributed feedback diode laser and a 375-nm external cavity diode laser for in situ measurements of atomic mercury emissions from coal-fired combustors.

ThA4 • 9:40 a.m.
Detection of Impurity Phases at the Surface of Solid Oxide Fuel Cells via Ellipsometry and Raman Scattering, *Andreas Ehn, Mathias Pagels-Fick, Mark Linne; Lund Inst. of Technology, Sweden.* Optical diagnostics have been evaluated to observe the time dependence of segregation of impurity phases at solid oxide fuel cell anodes.

Lakeside C
ThB • New Methods & Instrumentation II
10:20 a.m.–11:50 a.m.
Mark Linne; Lund Inst. of Technology, Sweden, Presider

ThB1 • 10:20 a.m. INVITED
New Light Sources - Wide Tuning Range and Rapid Scanning Blue Extended Cavity Diode Lasers, *Johan Hult, Iain S. Burns, Clemens F. Kaminski; Univ. of Cambridge, United Kingdom.* This paper presents two extended cavity diode laser tuning schemes, implemented using blue diode lasers, the first allows long mode-hop free tuning ranges (>110 GHz), whereas the second allows very high scan rates (>10 kHz).

ThB2 • 10:50 a.m.
Generation of Pulsed Ultra-Violet and Mid-Infrared Super-Continua in Standard Single-Mode Fiber, *Renata J. Bartula, Christopher L. Hagen, Joachim W. Walewski, Scott T. Sanders; Univ. of Wisconsin at Madison, USA.* The coverage of super-continua generated in optical fibers was expanded in a straight-forward manner to cover the ultraviolet and the mid-infrared region. The generated light covered 337-405 nm and ~ 1.5-3.4 μm, respectively.

ThB3 • 11:10 a.m.
Diode Laser-Based Photoacoustic Detection Using a Micromechanical Cantilever Transducer, *Toni Laurila, Heidi Cattaneo, Rolf Hernberg; Tampere Univ. of Technology, Finland.* A novel sensitive approach to detect weak pressure variations has been applied to diode laser-based photoacoustic spectroscopy. In the transducer a compact Michelson interferometer is used to measure the deflections of a micromechanical silicon cantilever.

ThB4 • 11:30 a.m.
Laser-Target Generation of Soft X-rays, *Michael S. Brown[1], Gary Switzer[1], James R. Gord[2], William M. Roquemore[2], Aaron Bernstein[3], Daniel Symes[3], Todd Ditmire[3]; [1]Innovative Scientific Solutions, Inc., USA, [2]Propulsion Directorate, USA, [3]Physics Dept., Univ. of Texas, USA.* Doped liquid targets are used in fs-laser-target interaction studies to generate soft x-rays for diagnostic applications such as small-angle scattering and radiography.

Lakeside C
ThC • Combustion III
1:00 p.m.–2:50 p.m.
Joachim W. Walewski; Univ. of Wisconsin at Madison, USA, Presider

ThC1 • 1:00 p.m. INVITED
Advances in Diode Laser Absorption Sensors for Combustion and Propulsion, *Ronald K. Hanson; Stanford Univ., USA.* Progress is reported in the evolution of diode laser sensors for combustion and propulsion systems. Applications are diverse, ranging from IC engines and gas turbine combustors to pulse detonation engines and scramjets.

ThC2 • 1:30 p.m.
Frequency Locking of Blue/Violet Extended-Cavity Diode Lasers for Dynamic Sensing Applications, *Iain S. Burns, Johan Hult, Clemens F. Kaminski; Dept. of Chemical Engineering, Univ. of Cambridge, United Kingdom.* We report on the use of $^{130}Te_2$ absorption lines in active laser-locking of the emission of a violet extended-cavity diode laser with a wavelength of around 410 nm.

ThC3 • 1:50 p.m.
Diode-Laser-Based Sum and Difference Frequency Generation for High-Speed UV and MIR Absorption Spectroscopy, *Terrence R. Meyer[1], Sukesh Roy[1], Thomas N. Anderson[2], Robert P. Lucht[2], Rodolfo Barron-Jimenez[3], James R. Gord[4]; [1]Innovative Scientific Solutions, Inc., USA, [2]School of Mechanical Engineering, Purdue Univ., USA, [3]Dept. of Mechanical Engineering, Texas A&M Univ., USA, [4]Propulsion Directorate, AFRL, USA.* Sum- and difference-frequency mixing are used to extend the range of high-speed diode-laser-based absorption sensors to ultraviolet and mid-infrared wavelengths. Measurement bandwidths up to 20 kHz are demonstrated in laboratory flames and model combustors.

ThC4 • 2:10 p.m.
OH Ground-State Energy Transfer Investigated Using Picosecond Two-Color Resonant Four-Wave-Mixing Spectroscopy, *Xiangling Chen, Thomas B. Settersten; Sandia Natl. Labs, USA.* Picosecond two-color resonant four-wave-mixing spectroscopy was demonstrated as a powerful technique for investigation of collisional relaxation of population and molecular anisotropy in the electronic ground state of the hydroxyl radical in an atmospheric-pressure flame.

ThC5 • 2:30 p.m.
Investigation of Two-Color Laser-Induced Fluorescence (TC-LIF) and Two-Color Six-Wave Mixing Spectroscopy (TC-SWM) for Detection of Atomic Hydrogen, *Waruna D. Kulatilaka[1], Robert P. Lucht[1], Thomas B. Settersten[2]; [1]Purdue Univ., USA, [2]Sandia Natl. Labs, USA.* We report picosecond two-color laser-induced fluorescence and six-wave mixing spectroscopy of atomic hydrogen in flames. Effects of the pump-beam polarization on the signals and collisional dynamics of H(2l) level were studied.

Lakeside C
ThD • LIBS II
3:20 p.m.–5:20 p.m.
Jagdish Singh; Mississippi State Univ., USA, Presider

ThD1 • 3:20 p.m. INVITED
New Frontiers in LIBS for Bio and Nano Applications, *Richard Russo; Lawrence Berkeley Natl. Lab, USA.* Advances in broadband LIBS have spawned applications in biochemical and nanomaterial sciences. Experimental configurations and parameters space for these applications will be described, covering techniques for achieving sub-micron spatial resolution and an overview of capabilities.

ThD2 • 3:50 p.m. INVITED
LIBS: A New Tool for Forensic Analyses, *Michael Sigman, Candice Bridge, Katie Vomvoris, Jean M. MacInnis; Natl. Ctr. for Forensic Sciences and Dept. of Chemistry, Univ. of Central Florida, USA.* LIBS was used to discriminate between float-glass samples and found to be comparable to LA-ICP-MS. Both techniques had discrimination powers exceeding 95% at the 99% confidence interval.

ThD3 • 4:20 p.m.
Spark-Induced Breakdown Spectroscopy-Based Monitor for Hazardous Airborne Biological Material, *Amy J. R. Bauer, David M. Sonnenfroh, Richard T. Wainner, Lawrence G. Piper, Seonkyung Lee, Steven J. Davis; Physical Sciences Inc., USA.* Spark-induced breakdown spectroscopy (SIBS) is a LIBS-like method of measuring the elemental composition of a sample excited with an electrically-generated plasma. Recently SIBS has been applied to monitoring hazardous airborne biological materials in ambient air.

ThD4 • 4:40 p.m.
MP-LIBS, a Laser Induced Breakdown Spectroscopy Tool for Homeland Security, *Roy A. Walters[1], Jeremy B. Rose[1], Frank C. DeLucia[2], Andrzej W. Miziolek[2]; [1]Ocean Optics, Inc., USA, [2]ARL, USA.* A first responder system called Man Portable LIBS, a full laboratory LIBS system in a backpack has been developed to supply an operator in less than one second with the answer to "What is it?"

ThD5 • 5:00 p.m.
Progress in the Use of Field LIBS Systems, *Andrzej Miziolek[1], Frank DeLucia, Jr.[1], Chase Munson[1], Roy Walters[2]; [1]ARL, USA, [2]Ocean Optics, Inc., USA.* The recent development of the man-portable Laser Induced Breakdown Spectroscopy (MP-LIBS) as well as standoff (ST-LIBS) systems has opened up a large number of field analytical applications. This talk will review current progress.

LACSEA 2006 Key to Authors and Presiders

Notes

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The *LACSEA Technical Digest* on CD-ROM will contain PDFs of paper summaries presented during the meeting as they were submitted by the authors; the *Technical Digest* will be produced only on CD. At the meeting, each registrant will receive a copy of the Technical Digest on CD-ROM.

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