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Laser Applications to Chemical, Security, and Environmental Analysis: introduction to the feature issue

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The field of analytical laser spectroscopy is continuously advancing as new laser sources, systems, and detection strategies become available. Indeed, as the optics community celebrated the 50th anniversary of the laser, the 12th Biennial Meeting on Laser Applications to Chemical, Security, and Environmental Analysis (LACSEA) celebrated a wide range of new innovations in laser metrology. The meeting was held from 31 January to 3 February as part of the Optical Society of America’s Congress on Lasers, Sources, and Related Devices in San Diego, California. This meeting, along with related short courses and exhibits, was collocated with topical meetings on Advanced Solid-State Photonics (ASSP) and Applications of Lasers for Sensing and Free Space Communications (LS&C). The LACSEA meeting included 65 single-track oral presentations, 8 poster presentations, and a joint session with ASSP and LS&C consisting of 3 invited talks. Topics covered advances in new laser sources for spectroscopy, such as super-continuum sources, difference-frequency mixing, and quantum cascade lasers (QCLs) for detection of trace gases and hazardous materials. Innovations in imaging included new strategies for tomography and high-speed imaging, and advanced sensing strategies included coherent detection schemes, photoacoustic spectroscopy, frequency comb spectroscopy, and cavity-enhanced methods for ultrasensitive detection. A variety of new diagnostics have also evolved based on the availability of high-power femtosecond chirped-pulse amplified lasers, such as femtosecond pulse shaping for biochemical applications and ultrafast coherent anti-Stokes Raman scattering (CARS) techniques for vapor-phase thermometry and speciation. Finally, a variety of other innovations were reported for surface measurements, thermometry in flames, nanoparticle synthesis, detection of hazardous materials and pathogens, standoff detection, and remote sensing, to name a few.

This special feature of Applied Optics is an excellent representative sample of these topics, covering a wide range of innovations in laser spectroscopy. Applications in this issue include trace sensing of species using radar REMPI and QCL systems, detection of combustion species using laser-induced incandescence and CARS, measurement of thin films,
measurements in hypersonic flows, and Raman lidar of ship wakes. Indeed, the multidisciplinary nature of the LACSEA meeting brings together papers on new laser sources that allow measurements from the ultraviolet to the infrared, narrowband to hyperspectral, continuous wave to ultrafast, and time averaged to spatiotemporally resolved. It is this multidisciplinary nature that provides a unique opportunity for researchers to exchange ideas and expand their horizons in laser measurements for chemical, security, and environmental analysis. In this manner, innovations in one field quickly find their way to a variety of applications. As a result, it has been the tradition of the LACSEA meeting to draw significant interest from researchers in physics, chemistry, and engineering from throughout the world, and the 2010 meeting and special issue are no exceptions. We hope you find this special issue of interest, and we invite you to consider contributing a paper, presenting, and participating at the next biennial meeting to be held in early 2012.

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